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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Chemical Information Division of the Office of Pesticides and Toxic Substances, Environmental Protection Agency

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

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80-2101. Bates, J. A. R. (FAO Plant Prot. Serv., Rome, Italy) **Hodnotenie a vyznam rezidui pesticidov v potravinach. [Evaluation and significance of pesticide residues in foods.]** *Agrochemia* 20(3): 77-80; 1980 (7 references) (Slovak).

The methodology used in evaluating the level and toxicological significance of pesticide residues in foods is discussed. Data collection on residues as the basis for pesticide certification and the determination of maximum permissible limits are presented. The planning of experiments designed to determine residue levels, sampling, and the analytical methods used are considered. A discussion of toxicological assessment (short-and long-term risk to personnel handling pesticides, first aid in accidents, pesticide labeling, acute toxicity, carcinogenicity and symptoms) is included. Maximum permissible daily allowance, the FAO and WHO food standards program, Recommended Codex Maximum Limits for Pesticide Residues and the assessment of actual exposure/intake of pesticides in diet are also considered.

80-2102. Vanurova, E. (Ukzuz-okor, Brno, Czechoslovakia) **Zhodnoeni povolenych rodenticidu u nas a perspektiva novych pripravku. [Evaluation of rodenticides certified in the CSSR and the prospect for new preparations.]** *Agrochemia* 20(3): 84-85; 1980 (4 references) (Czech).

Stringent requirements for the use of rodenticides to control *Microtus arvalis* in Czechoslovakia are given. High toxicity to the pest, safety for humans, non-target insects, wildlife and myophages, and rapid decomposition must be demonstrated before rodenticides can be used. Endrin is the only rodenticide certified in Czechoslovakia for use as a surface spray. The rodenticidal effects of scilliroside, endosulfan, camphechlor (toxaphene) and carbofuran, and the prospects of monocrotofos (Nuvacron 40 WSC, Ciba-Geigy), are considered. Phosphine, baits, modes of application, and the mechanized spreading of rodenticides are presented. The Czechoslovakian products Stutox and grazin, the imported products Arrex M Koeder klein and Castrix Pellets (crimidine), and preparations based on dimefox, Delicia (aluminum phosphide) chlorphacinone granules, difenacoum and brodifacoum are also discussed.

80-2103. Dirlbek, K. (Coll. Nat. Sci., Charles Univ., Prague, Czechoslovakia) **Vztah pesticidy – puda – prostredi v hodnoceni vedoucich pracovniku JZD. [The pesticide – soil – environment relationship as assessed by JZD managers.]** *Agrochemia* 20(3): 87-89; 1980 (Czech).

Pesticide usage data obtained as part of the 1975 CEMA Department of the Geographic Institute of the Czechoslovak Academy of Sciences study entitled *The Methodology of Economic and Other-than-economic Impacts of Man on the Environment*, and responses to 6 questions given to 400 agricultural cooperatives, are evaluated. Pesticide use is found to have increased 10-400% over the past 10 yr. The percentage of land area treated with pesticides increased 50-75%. The pesticide dose applied per hectare was ~ 7 kg/ha. Negative side effects of pesticide application on the environment included damage to insects and wildlife (13% respondents), damage to crops (3%), damage to fish (3%) and damage to soil (2%).

80-2104. O'Flynn, M.; Green, P. E.* (Anim. Res. Inst., Dep. Primary Ind., Yeerongpilly, Queensland 4105, Australia) **Insecticide resistance in field strains of *Lucilia cuprina*.** *Aust. Vet. J.* 56(2): 67-69; 1980 (18 references).

In a field survey conducted in 1977-78, 19 strains of *Lucila cuprina* demonstrated resistance to diazinon, fenthion-ethyl, dichlofenthion and chlorfenvinphos. A large percentage of larvae were more susceptible to chlorfenvinphos than to the other chemicals tested. Six of the strains demonstrated no resistance to butacarb. An experimental strain collected in 1967 and selected with diazinon for 117 generations showed resistance factors for organophosphorus compounds far greater than those attained by the field strains in this study.

80-2105. Kalmakoff, J.; Miles, J. A. R. (Dep. Microbiol., Univ. Otago, Dunedin, New Zealand) **Ecological approaches to the use of microbial pathogens in insect control.** *BioScience* 30(5): 344-347; 1980 (19 references).

The use of pathogens as a means of biological insect control is reviewed. Ways to maximize the utility of pathogens by gaining an understanding of the ecology of the target organism and its pathogens are discussed, along with measures required to ensure that no ill effects will result from introduction of the pathogen. Three methods of utilizing pathogens are discussed. These are the insecticidal approach, in which an insect pathogen preparation is applied to the agroecosystem in a manner similar to that used with chemical insecticides; the limited-release approach, in which the pathogen is applied as a single application at an appropriate time, leading to a stable host/pathogen complex; and the manipulation of pathogens already present in the pest population. Specific examples of the field use of each method are given. The use of microorganisms and parasites to control populations of disease vectors is discussed in detail. The importance of studying the effects of these pathogens on the ecosystem is emphasized, and the five general stages of safety testing are described.

80-2106. Adam, R. J. (Horton Gen. Hosp., Banbury, Oxford OX16 9AZ England) **Non-fatal disease due to inhalation of nebulised paraquat.** *Br. Med. J.* 280(6222): 1120-1121; 1980.

This letter to the editor briefly reports a possible episide of paraquat poisoning by inhalation. A man, who worked in a stone quarry using a diamond stone cutting saw which required water cooling, used an old plastic container found at the quarry to hold the water. As he worked, a fine spray of water was blown into his face by the action of the saw. Symptoms of cough, fever and malaise occurred 36-48 hr after he had worked in the quarry on 7 separate occasions. Chest X-rays taken during these episodes were not significantly altered. Investigation revealed the container had previously contained paraquat and the spray of water was thereby contaminated. After the container was replaced no further symptoms were noted.

80-2107. Johnston, H. W.; MacLeod, J. A.; Clough, K. S. (Res. Stn., Agric. Canada, Charlottetown, Prince Edward Island C1A 7M8, Canada) **Effects of cycocel (CCC) and fungicide sprays on spring wheat grown at 3 nitrogen levels.** *Can. J. Plant. Sci.* 59(4): 917-930; 1979 (26 references).

Spring wheat *(Triticum aestivum* L. Opal) was grown at three N levels, 80, 120, and 160 kg N/ha, to evalate effects of Cycocel (chlormequat chloride; CCC) and fungicide sprays in a 2-yr test. CCC decreased yields, in the absence of lodging, by increasing disease severity. Fungicides decreased disease severity while increased levels of N increased the severity of powdery mildew. The combination of high N plus fungicides produced the highest yields because the healthier plants gave greater responses to higher levels of N than did diseased plants. Levels of N above the 80 kg/ha rate did not increase yield of Opal wheat in the absence of appropriate fungicide sprays. (Author abstract by permission)

80-2108. Townsend, L. R.; McRae, K. B. (Res. Stn., Agric. Canada, Kentville, Nova Scotia B4N 1J5, Canada) **The effect of the nitrification inhibitor nitrapyrin on yield and on nitrogen fractions in soil and tissue of corn *(Zea mays* L.) grown in the Annapolis valley of Nova Scotia.** *Can. J. Plant. Sci.* 60(2): 337-347; 1980 (15 references).

The application of fertilizer (10-10-10) treated with the nitrification inhibitor nitrapyrin [2-chloro-6-(trichloromethyl) pyridine] was generally not effective in increasing the yields of grain corn, although at one location the addition of stabilized fertilizer increased the yield ($P = 0.25$) by 660 kg/ha over that from plots receiving non-stabilized N fertilizer. Nitrapyrin did not affect the levels of the N fractions in corn tissue but it did inhibit nitrification of soil NH_4-N. As might be expected, the addition of fertilizer and increasing fertilizer rates increased yields and levels of N in tissue and soil. (Author abstract by permission)

80-2109. Major, D. J. (Res. Stn., Agric. Canada, Lethbridge, Alberta T1J 4B1, Canada) **Effect of simulated frost injury induced by paraquat on kernel growth and development in corn.** *Can. J. Plant. Sci.* 60(2): 419-426; 1980 (19 references).

Four corn *(Zea mays* L.) hybrids, grown at Lethbridge, Alberta, in 1975, 1976, and 1977, were sprayed on 3 dates with paraquat in an attempt to produce symptoms similar to those of a first killing frost. Interactions among hybrids and treatments were rare for characteristics such as grain yield, test wt, and kernel moisture content. The most pronounced effect of paraquat was that yield was reduced by about 1000 kg/ha for each wk the simulated frost occurred before maturity. Development was affected less than yield. Treatments that resulted in a yield reduction of 10% only caused a 15% reduction in test wt. Kernel development was closely related to the accumulation of growing degree days with a base of 12°C. Kernel moisture content was higher immediately after paraquat treatment, but rate of moisture loss was also slightly higher so that the paraquat treatments caught up to the checks and finally had a slightly lower moisture content. The earlier the paraquat treatment was imposed, the greater was the reduction in growth rate of grain. In addition, a very early paraquat treatment resulted in a longer effective filling period duration (EFPD), and a later imposition of the paraquat treatment caused a reduction in the EFPD compared to the check treatments. (Author abstract by permission)

80-2110. Rioux, R.; Comeau, J. E. (Ferme Exp., Agric. Canada, La Pocatiere, Quebec GOR 1Z0, Canada) **Influence des systemes de culture sur la croissance et le rendement des pommes de terre. [Influence of cultural systems on the growth and yield of potatoes.]** *Can. J. Plant. Sci.* 60(2): 591-598; 1980 (23 references) (French).

Three cultural systems for potato *(Solanum tuberosum* L.) are evaluated on 2 soil types. A flat seedbed with hilling at the flowering stage promotes earlier plant growth and a higher early tuber yield than the traditional system (ridged seedbed with hilling at emergence) now used in Quebec. It also emphasizes the earliness of cv. Norland. Final yield with the above system is lower than with the traditional system in the presence but not in the absence of weeds. A ridged seedbed with hilling at the 15 to 20 cm stage gives low yields, particularly under wet soil conditions. The linear relationship between the site year and cultural system mean yields confirms these results. Linuron reduces tuber yield when used with the traditional system. Results indicate that potential yield is determined by leaf area but the actual yield level seems to be limited by rainfall during the latter part of the growing season. (Author abstract by permission)

80-2111. Crowley, J.; Prendeville, G. N. (Bot. Dep., Univ. Coll., Cork, Ireland) **Effects of herbicides of different modes of action on leaf-cell membrane permeability in *Phaseolus vulgaris.*** *Can. J. Plant. Sci.* 60(2): 613-620; 1980 (39 references).

Leakage of electrolytes from leaf discs of treated *Phaseolus vulgaris* L. plants was used to study the effects of several herbicides of different modes of action on leaf-cell membrane permeability. Linuron (*N*-(3,4-dichlorophenyl) -*N*-methoxy-*N*- methylurea), prometryne (4,6-*bis*-isopropylamino- 2-methylthio-1, 3,5-triazine), bromacil (5,bromo-6-methyl- 3-(1-methyl-n-propyl) uracil), sodium azide and dalapon (2,2-dichloropropionic acid) increased leaf-cell permeability at 24 hr after treatment and this occurred without appearance of leaf necrosis. Glyphosate (*N*-(phosphonomethyl) glycine) increased leaf-cell permeability at 96 hr and this was always associated with visible injury, including wilting. Paraquat (1,1-dimethyl-4, 4-bipyridylium) at 10^{-5} *M* increased leaf-cell permeability 48 hr after treatment, without apparent leaf damage, but at higher concentrations, increased permeability was always associated with visible effects. Chlorpropham [isopropyl *N*-(d)3-chlorophenyl) carbamate], picloram (4-amino-3,5,6-trichloropicolinic aci d) and 2,4-D (2,4-dichlorophenoxyacetic acid) did not alter cell permeability even though epinastic symptoms in leaves became evident 24 hr after treatment with picloram and 2,4-D. (Author abstract by permission)

80-2112. Warwick, S. I.; Black, L. (Biosystematics Res. Inst., Cent. Exp. Farm, Agric. Canada, Ottawa, Ontario K1A OC6, Canada) **Uniparental inheritance of atrazine resistance in *Chenopodium album*.** *Can. J. Plant. Sci.* 60(2): 751-753; 1980 (14 references).

Reciprocal crosses conducted on atrazine resistant and susceptible biotypes of *Chenopodium alum* L. indicated uniparental inheritance through the female parent for F_1 progeny. Seed from reciprocal crosses was sown, and 4 wk after emergence plants were screened for atrazine resistance. The total surface of 1 fully expanded leaf from each seedling was brushed with atrazine solution at a dose equivalent to 0.001 g/cm² leaf surface. Susceptible plants showed necrotic spots within 3 days and total leaf necrosis after 7 days. After 3 wk susceptible plants had died or showed severe malformation and stunted growth. Resistant plants showed no phytotoxic symptoms. (Author abstract by permission, modified)

80-2113. Dirks, V. A.; Friesen, G. H. (Res. Stn., Agric. Canada, Harrow, Ontario N0R 1G0, Canada) **Tolerance of fresh market transplanted tomatoes to metribuzin applied at various dates after transplanting.** *Can. J. Plant. Sci.* 60(2): 759-761; 1980 (7 references).

Metribuzin applied to fresh market field tomatoes *(Lycopersicon esculentum* Mill. Springset) at 2-day intervals, from 10 to 30 days after transplanting did not affect yield or fruit size in comparison with unsprayed weed-free plots in 1978 and 1979. A considerable period of tolerance to field applications of the herbicide is indicated. (Author abstract by permission)

80-2114. O'Leary, N. F.; O'Donovan, J. T.; Prendeville, G. N. (Bot. Dep., Univ. Coll., Cork, Ireland) **Effect of diclofop methyl and 2,4-D alone and in combination on leaf cell membrane permeability of wild oats and barley.** *Can. J. Plant. Sci.* 60(2): 773-775; 1980 (6 references).

Diclofop methyl {2-[4-(2,4-dichlorophenoxy)phenoxy]} propanoic acid increased leaf cell membrane permeability of wild oats at 48 hr and barley at 96 hr after treatment while 2,4-D did not affect leaf cell membrane permeability in either species. A combination of both herbicides had a similar effect on leaf cell membrane permeability of wild oats as diclofop methyl alone. In barley, the combination increased leaf cell membrane permeability at 24 hr after treatment compared to 96 hr with diclofop methyl alone. (Author abstract by permission)

80-2115. Gutierrez, M. L.; Crooke, S. T. (Dep. Clin. Cancer Res., Bristol Lab., Syracuse, NY 13201) **Mitotane *(o,p'*-DDD).** *Cancer Treat. Rev.* 7(1): 49-55; 1980 (32 references).

This review offers a brief history of the compound Mitotane (TDE) along with information on its chemistry and mechanism of action. While studies on the antineoplastic activity of Mitotane have been limited thus far, the chemical is active against several animal solid tumors and hematologic malignancies. No activity was demonstrated against Lewis lung carcinoma, Sarcoma 180, Novikoff hepatoma, Walker carcinosarcoma 256, melanotic melanoma and 14 animal hematologic malignant neoplasma. In man, after a single dose of *o,p'*-DDD, a maximum plasma concentration is obtained 3-5 hr later and an equilibrium reached between *o,p'*-DDD in the plasma and tissues within 12 hr. Reports of clinical studies and toxicities of the chemical are briefly noted.

80-2116. Robertson, J. H.; Cowen, W. F.; Longfield, J. Y. (Catalytic Inc., Philadelphia, PA 19102) **Water pollution control.** *Chem. Eng.* 87(13): 102-119; 1980 (18 references).

Activities in the field of water pollution control are reviewed. A brief history of major events in this area since the 1970's is given. The Clean Water Act of 1972, improvements in analytical technology in chromatography and spectroscopy, advances made in the fields of toxicology and medical research, and the creation of the National Commission on Water Quality are discussed. The EPA and needs for the 1980s regarding water pollution control, such as effluent guidelines for priority pollutants (including pesticides) and a continuation of studies into the occurrence of priority pollutants in the chemical process industries are also considered. Various aspects of treatment and control are considered including biological treatment, activated sludge, tertiary treatment (defined as any treat-

ment added beyond biological treatment) and in-plant control. The latter includes distillation and stripping, evaporation, solvent extraction, chemical oxidation, adsorption, chemical coagulation and precipitation, ion exchange and reverse osmosis. By-products of treatment are discussed briefly. Some consideration is given to dewatering and disposal of organic sludge. The detection of priority pollutants and quality control procedures are discussed.

80-2117. Gardiner, J. (Water Res. Cent., Stevenage Lab., Stevenage SG1 1TH, England) **Monitoring and control of discharges to tidal waters.** *Chem. Ind. (London)* 8: 307-312; 1980 (39 references).

The scientific and technical problems of monitoring and controlling discharges into British estuaries are discussed. Two extremes of pollution control strategies are described; maximum treatment with minimum discharge, and the maximum use of the capacity of receiving waters to dilute and degrade pollutants. Environmental quality objectives are presented. The first objective involves determining the quality of the receiving body and aiming further efforts at the protection of that water. The next step is defining standards. These standards are the levels of pollutants (pesticides, heavy metals, etc.) that will enable the environmental quality objectives to be realized. The establishment of provisions for monitoring discharges and environmental quality to insure the maintenance of established water quality is also discussed. Threshold concentrations for some organic pollutants (including 2,4,6-trichlorophenol and *o*-dichlorobenzene) in water are presented in tabular form.

80-2118. Nayak, D. N.; Pasalu, I. C.; Rao, V. R. (Lab. Soil Microbiol., Cent. Rice Res. Inst., Cuttack 753006, India) **Influence of natural and synthetic insecticides on nitrogen fixation (C_2H_2 reduction) in the rice rhizosphere.** *Curr. Sci.* 49(3): 118-119; 1980 (7 references).

In this letter to the editor a short discussion of the effects of organophosphate insecticides and some natural products with insecticidal properties on nitrogen fixation is presented. Quinalphos and phosalone were applied at 0.5 kg/ha; 0.005% pyrethrum, 1% neem extract, 1% neem oil, and 0.5% allitin were sprayed on plants 50, 65 and 75 days after transplantation. Acetylene reduction in the soil was assessed 10 days after each spraying. Nitrogen fixation peaked within the first 60 days and declined thereafter. All the compounds that were tested inhibited fixation. The amount of inhibition varied with each compound. After 60 days, pyrethrum caused the greatest amount of inhibition. After 75 days, neem oil and quinalophos were the most inhibitory. By day 85 there was little difference in the effects of the compounds. It is suggested that careful evaluation of the effect of pesticides on nitrogen fixation in the soil is necessary.

80-2119. Banwell, J. G. (Div. Gastroenterol., Dep. Med., Coll. Med., Univ. Kentucky, Lexington, KY 40536) **Environmental contaminants and intestinal function.** *Environ. Health Perspect.* 33: 107-114; 1979 (50 references).

Environmental contaminants which affect the small intestine are reviewed. Environmental chemicals such as insecticides and polychlorinated biphenyls may enter the human digestive tract through the mouth or via the respiratory tract. In most cases the specific target effects of these chemicals on the small intestine are not known. There are only a few cases where epidemiological data have identified an intestinal illness associated with gross contamination by one of these chemicals. The metabolic interactions of toxic substances are considered; bacterial metabolism, brush border enzymes and mucosal cell metabolism are discussed.

80-2120. Tsai, C. F.; Welch, J.; Chang, K. Y.; Shaeffer, J.; Cronin, L. E. (Chesapeake Biol. Lab., Cent. Environ. & Estuarine Stud., Univ. Maryland, Solomons, MD 20688) **Bioassay of Baltimore Harbor sediments.** *Estuaries* 2(3): 141-153; 1979 (22 references).

A sediment bioassay study of Baltimore Harbor was carried out as part of an effort to develop a feasible program of correction for the harbor's existing pollution burdens. Nine stations were sampled and 2 fish species, mummichogs *(Fundulus heteroclitus)* and spot *(Leiostomus xanthurus)*, and 1 mollusc species, the soft-shell clam *(Mya arenaria)*, were used. The test organisms were placed in static bioassay tanks and exposed to a series of 5 sediment concentrations from each station. Sediment samples were analyzed for Pb, Cr, Zn, Cd, As, Hg, Cu, Mn, Ni, and PCBs, as well as for hexane extracts. All sediment samples were substantially polluted, but a wide variation among stations was noted. Hexane extracts correlated significantly with bulk concentrations of PCBs, Pb, Cr, Zn and Cd. The 24 hr and 48 hr TLm values (median tolerant levels, the concentrations at which 50% of the test populations were killed by exposures for 24 and 48 hr, respectively) increased proportionally with sediment concentrations. Spot were more susceptible to suspended solids than mummichogs, and soft-shell clams were very tolerant to toxic materials and to suspended solids. It is concluded that the gross toxicity of sediments, as determined by the fish bioassay, can be used as an index to indicate the degree sediment toxicity will affect benthic macro-invertebrate communities.

80-2121. Maki, A. W. (Environ. Saf. Dep., Procter & Gamble Co., Cincinnati, OH) **An introduction to the Environmental Concerns Committee. Part 2, Area 2. Effects of toxic substances in surface waters.** *Fisheries* 4(4): 16-19; 1979.

The persistance and accumulation of hazardous substances in the environment such as DDT, PCB, and

chlordecone have necessitated new manufacturing and waste treatment procedures to protect aquatic life. All chemical substances may be considered to have an effect on the aquatic environment, but their relative toxicity will depend mainly upon their potential of reaching aquatic communities, their rate of degradation and their degree of accumulation or persistance. Endrin contamination along the Mississippi River, PCB pollution of the lower Hudson, and the impact of chlordecone on the aquatic life of the James River are mentioned as examples of poorly planned pesticidal use. The effects of DDT, PCB, and heavy metals on fish, shellfish and other aquatic organisms are discussed. It is suggested that aquatic scientists become involved in evaluating the potential hazards of new chemical products before they are marketed for use. Other needed actions to protect the aquatic environment are recommended for implementation by the AFS Water Quality Section.

80-2122. Claydon, N.; Grove, J. F.; Pople, M. (Agric. Res. Counc., Unit. Invert. Chem. & Physiol., Univ. Sussex, Brighton, East Sussex, BN1 9RQ, England) **Insecticidal secondary metabolic products from the entomogenous fungus *Fusarium larvarum*.** *J. Invertebr. Pathol.* 33(3): 364-367; 1979 (7 references).

Three strains of the fungus *Fusarium larvarum* were examined for the production of insecticidal secondary metabolites. Culture extracts were tested for pathogenicity and insecticidal activity using adults of the blowfly *Calliphora erythrocephala* and larvae of the mosquito *Aedes aegypti*. In addition, fermentation and spectrophotometric and thin-layer chromatographic analyses for secondary metabolites were carried out. None of the extracts showed larvicidal activity against *A. aegypti*. None of the strains were pathogenic to *C. erythrocephala*, but solvent extracts of the culture filtrates of 2 of the strains showed insecticidal activity against the blowfly. The known fungal metabolic products monocerin and (+)-mellein and the new natural products 7-0-demethylmonocerin, fusarentin 6-methyl ether, and fusarentin 6,7-dimethyl ether were identified. The major metabolites, monocerin and the fusarentin ethers, showed insecticidal activity.

80-2123. Alekseev, R. V. (Natl. Seed Storage, USSR) **Vliyanie mineral'nykh udobrenii i gerbitsidov na posevnye svonstva semyan tomatov pri khranenii. [Effect of mineral fertilizers and herbicides on drilling properties of tomato seeds during storage.]** *Khim. Sel'sk. Khoz.* 18(3): 22-23; 1980 (Russian).

The effect of mineral fertilizers and herbicides on drilling properties of tomato seeds subjected to prolonged storage was studied. It was found that treatment with diphenamide (7 kg/ha), Nitrofor (6 and 9 kg/ha), Planovin (nitralin; 2 kg/ha), Treflan (trifluralin, 6 kg/ha), and TCA (17 kg/ha) did not decrease the energy of germination of tomato seeds stored for up to 6 yr. Best results were obtained after application of Nitrofor and Treflan.

80-2124. Karyagin, Ya. G.; Boiko, A. T.; Molotkov, V. I. (Res. Inst. Soil Sci., Kazan, USSR) **Effektivnost' linurona na posevakhsoi. [Efficacy of linuron in soy bean crop.]** *Khim. Sel'sk. Khoz.* 18(3): 45-46; 1980 (Russian).

The result of field trials of herbicide linuron in soy bean crops are reported. Linuron at 2-3 kg/ha enhanced functional activity of rhizobia and improved the development of assimilation apparatus of soy plants. Enhanced carbohydrate and nitrogen metabolism was observed, and resulted in increased yield. Linuron at 5 kg/ha was toxic to soy plants. Increased moisture content of the soil was found to increase the toxicity of linuron.

80-2125. Parshutin, S. M. (All-Union Res. Inst. Chem. Means Plant Prot., Leningrad USSR) **Trikloratsetat natriya. [Sodium trichloroacetate.]** *Khim. Sel'sk. Khoz.* 18(3): 46-47; 1980 (Russian).

Properties of sodium trichloracetate (sodium TCA) are reviewed. TCA is a selective systemic herbicide effective against annual and perennial cereal weeds. Toxicity of the herbicide at 20 kg/ha depends upon the moisture content and type of soil. TCA is mildly toxic for warm-blooded animals (LD50 for rats is 3320 mg/kg). TCA causes slight irritation of skin and mucous membranes. Maximum permissible residual amounts of TCA in vegetables, grain and fruits is 0.01 mg/kg.

80-2126. Vernberg, W. B., ed.; Thurberg, F. P., ed.; Calabrese, A., ed.; Vernberg, F. J., ed. (Sch. Public Health, Univ. South Carolina, Columbia, SC) **Marine Pollution: Functional Responses. Proceedings of the Symposium *Pollution and Physiology of Marine Organisms*.** *Marine Pollution: Functional Responses.* (Academic Press: NY) 454 pp.; 1979.

This book contains papers presented at the symposium entitled *Pollution and Physiology of Marine Organisms*. The book is divided into four parts; petroleum hydrocarbons, metals, pesticides and PCBs, and multiple factor interactions. The effects of pollutants on marine organisms are considered, including discussion of the present level of knowledge and future research needs. The sublethal effects of numerous pollutants are emphasized. Abstracts of items from this book will appear in appropriate sections of this issue of *Pesticides Abstracts*.

80-2127. Nimmo, D. R. (Environ. Res. Lab., US EPA, Gulf Breeze, FL) **Pesticides: their impact on the estuarine environment.** In: *Marine Pollution: Functional Responses.* Vernberg, W. B., et al., eds. (Academic Press: NY): pp. 259-270; 1979 (37 references).

An overview is presented of the effects of pesticides on estuarine environments. The development of public awareness of the hazards of pesticides, and factors

that influence the use of pesticides, are described. The decline in DDT use since 1965 and the registration of < 100 new chemicals for use as pesticides since 1972 are discussed. Studies carried out following cessation of pesticide use indicate that levels of persistent chemicals do diminish, but rates of decline may be slow due to slow degradation rates. The cases of the persistent chemicals DDT and Kepone (chlordecone) are noted. The increasing use of herbicides, generally considered to be less toxic to estuarine species than other pesticides, is considered. New pesticides likely to be used in the future, such as the pyrethroids and insect growth regulators, are discussed. Pyrethroids show high insecticidal and low mammalian toxicity. Altosid (methoprene), a juvenile hormone, is required to be present only during a critical life stage of the target species, which decreases chances of delayed toxicity or bioconcentration. Dimilin (diflubenzuron) acts by interfering with the molting process, and has been shown to be moderately persistent. The observed effects of the pesticides malathion, DDT, Strobane, chlordane and DDE are listed in a discussion of the need for testing of pesticides before their use. Effects mentioned include the failure of eggs to develop in sea trout exposed to DDT and depressed acetylcholinesterase activity in brain tissue of fish exposed to malathion.

80-2128. Caldwell, R. S.; Caldarone, E. M.; Rosene, B. A. (Dep. Fish. and Wildl., Mar. Sci. Cent., Oregon State Univ., Newport, OR) **Fatty acid composition of phospholipids in thermally acclimating sculpins *(Leptocottus armatus)* treated with polychlorinated biphenyls (Aroclor 1254).** In: *Marine Pollution: Functional Responses.* Vernberg, W. B., et al., eds. (Academic Press: NY): pp. 271-290; 1979 (41 references).

Results are reported of studies on the fatty acid composition of phospholipids of thermally acclimating sculpins *(Leptocottus armatus)* treated with Aroclor 1254 (known to be a potent MFO inducer in animals). Juvenile staghorn sculpins were given ip injections of the PCB at a dose of 30 mg/kg. The temperature of one aquarium was gradually lowered to 7°C, and that of a second aquarium raised to 19.2°C. The fish were allowed to acclimate for 12 days, the lipids were extracted, and phospholipid fatty acids were determined by gas chromatography. The results indicate a modification of the pattern of fatty acids in whole body phospholipids of treated fish, with more saturated fatty acids observed. The level of docosahexaenoic acid declined. The levels of short chain saturated and monosaturated acids including palmitic acid, stearic acid and oleic acid increased. It is suggested that Aroclor treated fish may be functionally adapted to a temperature approximately 13°C higher than their acclimation temperature.

80-2129. Sinderman, C. J. (Sandy Hook Lab., Northeast Fish. Cent., Natl. Mar. Fish. Serv., Natl. Oceanic & Atmos. Admin., US Dep. Commer., Highlands, NJ) **Beyond the LC50: an opinion about research activities and needs concerning physiological effects of pollutants in the environment.** In: *Marine Pollution: Functional Responses.* Vernberg, W. B., et al., eds. (Academic Press: NY): pp. 437-450; 1979 (19 references).

Physiologic toxicity studies for heavy metals, petroleum products and halogenated hydrocarbons are discussed. Toxicity assessment methods more meaningful than short-term LC50 studies are presented. The development of toxicity resistance and the uncertainty about multiple pollutant effects on marine organisms are considered. The shift from short-term lethal toxicity studies to long-term sublethal studies is discussed. Long-term studies include investigations into the metabolic breakdown of toxicants, the physiological basis for resistance, and monitoring based on the physiological and biochemical responses to toxicants.

80-2130. Homer, R. F. (Biosci. Group, Natl. Res. Dev. Corp., Oxford, England) **The NRDC role: Cephalosporin antibiotics and pyrethroid insecticides.** *Mfg. Chem. & Aerosol News* 51(4): 17-21; 1980 (2 references).

The development of synthetic pyrethroid insecticides by NRDC is reviewed. The development of these pesticides resulted from a methodical evolutionary program of synthetic chemistry begun in 1961. Natural pyrethrum insecticide is obtained from *Chrysanthemum cinerariafolium,* cultivated in Kenya and Tanzania. This natural product has low mammalian toxicity, rapid knockdown of flying insects and negligible persistence. It is used in domestic aerosols or slow-burning formulations in mosquito coils. Similar chemical analogs were synthesized during World War II, but only allethrin was successful in commercial terms. Greater success was noted upon development of esters of halogenated chrysanthemic acids with 3-phenoxybenzyl alcohols. This combination increased the half life of the chemicals to a period of a few wk in the agricultural environment, and thus increased their effectiveness against field pests. Permethrin, cypermethrin and decamethrin have been most promising. Decamethrin has an activity 20-50 × that of bioresmethrin, depending on the species of insect.

80-2131. Tait, J. (Open Univ., Milton Keynes, England) **Treadmills and catastrophes in pest control.** *New Sci.* 86(1205): 254-256; 1980.

A treadmill of the use of more and more chemicals every year while still having the insect pests is described. Various pressures which keep farmers on this treadmill are discussed including the need for production of larger crop yields and crop yields free from obvious pest damage. Factors which influence how much pesticide a farmer will use are discussed, along with several factors which play little part in the decision. Greenhouse crops generally do not

need large amounts of pesticides and these farmers have turned to control systems based on natural pest enemies. The high level of resistance which developed in some pests to pesticides is largely responsible for the use of alternative controls in greenhouses. Public opinion is noted to be a factor against the widespread use of pesticides on field crops. A three dimensional model of the factors affecting pesticide use is presented.

80-2132. deBarsy, T.; Bronchart, R.; Benoit, M.; Ceustermans, N. (Dep. Bot., Univ. Liege, Sint Katelijne Waver, Belgium) **Action de tensio-actifs et de solvants utilises dans la formulation des pesticides sur le revetememt en cires epicuticulaires des feuilles du poireau *(Allium porrum* L.). [Effect of surfactants and solvent emulsions used for pesticide formulation on the coating of epicuticular waxes, partly responsible for the glaucousness of leek leaves *(Allium porrum* L.).]** *Parasitica* 34(4): 264-276; 1978 (27 references) (French).

Various concentrations of surfactants and solvent emulsions used in pesticide formulations were sprayed at several different concentrations on leaves of two leek lines. An evaluation was made of the changes in leaf cuticular waxy coating which is partly responsible for the dark green-blue color. The waxy coating was not changed by the surfactants and the dark color of the leaves was not changed. Solvent emulsions did cause changes in the waxy coating, inducing a shift of the dark green-blue to a clearer green shade. In about 15 days the waxy coating had regenerated. It is suggested that growers not spray leek cultures at intervals shorter than 15 days, to avoid a cumulative effect of alterations in the waxy coat.

80-2133. Anonymous **Assessing effects of maternal drug use.** *Patient Care* 14(10): 68-71, 75-77, 81-82, 84-86, 93-95, 99-101, 105-107, 111; 1980 (16 references).

Various questions posed regarding specific drug usage during pregnancy are discussed. A Norwegian study which measured DDT levels in breast milk and maternal fat in women in 1969 and again in 1976 is considered. The elevated levels found in 1969 did not decrease significantly during this 7 yr period, after the total ban on DDT went into effect in Norway. It is suggested that a woman with a large store of lipid-soluble chemicals may never get rid of them. It is also suggested that consideration be given to occupational hazards encountered by either partner before conception occurs. Female employees working near heavy industrial chemicals have shown 2-3× the anomaly risk from exposure as compared with control groups, regardless of previous toxic levels of chemicals in their bodies prior to job exposure. Treatment of pre-existing conditions is discussed. The use of crystalline warfarin sodium for phlebitis is not recommended. Maternal warfarin exposure has caused 15-20 cases of fetal warfarin syndrome. Warfarin sodium itself causes tripled epiphyses, a phenocopy of Conradi's disease in offspring.

80-2134. Diaz, M. A.; Chueca, A.; Lopez Gorge, J. (Dep. Biochem., Estn. Exp. Zaidin, C.S.I.C., Granada, Spain) **Effect of some herbicides on CO_2 fixation, intermediates pattern, and RuDP-carboxylase and FDPase activities of spinach chloroplasts.** *Pestic. Biochem. Physiol.* 13(2): 105-111; 1980 (26 references).

Herbicide inhibition of photosynthetic carbon dioxide fixation by isolated spinach chloroplasts was studied using phenmediphan, chloroxuron, dinoseb, dichlorbenil, dicamba, 2,4-D, 2,4-DB, and 2,4-DP (dichloroprop). Phenmedipham exhibited the strongest CO_2 assimilation inhibition, followed by chloroxuron and dinoseb; 50% inhibition occurred at 0.5-1 μM. Dichlobenil and 2,4-D were completely ineffective. A sharp decrease was noted in the trioses-P/P-glycerate ratio in the presence of phenmedipham and chloroxuron, indicating an inhibition of P-glycerate reduction by low NADPH synthesis. Dinoseb caused 25% inhibition of ribulose-1,5-diphosphate carboxylase activity at concentrations of 10-100 μM. It is suggested that these effects could contribute to the dinoseb inhibition of CO_2 assimilation by isolated chloroplasts. Other herbicides tested exhibited little or no effect on these enzyme systems.

80-2135. Hill, I. R., ed.; Wright, S. J. L., ed. (Imperial Chem. Ind., Plant Prot. Div., Jealott's Hill Res. Stn., Bracknell, England) ***Pesticide Microbiology. Microbiological Aspects of Pesticide Behavior in the Environment.*** *Pesticide Microbiology*. (Academic Press: London): 844 pp.; 1978.

The effects of pesticides on non-target species, particularly microorganisms, is becoming an important frontier in the study of the environmental impact of these compounds. This book endeavors to explain how pesticides should be used to minimize their detrimental effects while still obtaining satisfactory results on target organisms. Each chapter opens with an introduction to provide background material on a specific topic of pesticide microbiology. The microbial aspects of soil, plant, aquatic, air and animal environments are investigated and the behavior and fate of pesticides in microbial environments are considered. Pesticidal transformation in natural and experimental situations are dealt with, and some techniques used in determining effects of these compounds on non-target soil microbes are discussed. Interactions with microalgae, aquatic, and soil micro-fauna and microbial degradation of pesticides are also presented.

80-2136. Newman, J. F. (Imp. Chem. Ind., Plant Prot. Div., Jealott's Hill Res. Stn., Bracknell, Berkshire, England) **Pesticides.** In: *Pesticide Microbiology*. Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH01): 1-16; 1978 (18 references).

The use of pesticides in agriculture to increase crop yield and quality, and reduce the input of energy and labor

used in crop production, is discussed. The various types and uses of pesticides are covered in detail. Insecticides, fungicides, and herbicides are discussed in relation to their history, development and actions on the environment. The process of new pesticide development is outlined from the origin of the chemical through its biological and toxicological evaluation to its final formulation and application. The alterations produced in living systems are also considered.

80-2137. Esaac, E. G.; Matsumura, F. (Pestic. Res. Cent., Michigan State Univ., East Lansing, MI 48824) **Metabolism of insecticides by reductive systems.** *Pharmacol. Ther. Part A* 9(1): 1-26; 1980 (145 references).

The metabolism of insecticides by reductive systems, both biological and non-biological, and the mechanisms involved in their reductive capabilities, are reviewed. The insecticides discussed include DDT, lindane, dieldrin, DCNA (dichloran), PCNB (quintozene), fenitrothion, EPN, methyl parathion and mexacarbate. In the discussion of non-biological reductive systems attention is given to reduced porphyrins; electrochemical reduction; and high pressure, γ radiation and catalytic dechlorination. In considering biological reductive systems, information is offered on microorganisms in the soil, in rumen fluid, sewage, and water, and in defined microbial cultures. Insects and mammals are also discussed as biological reductive systems with emphasis on aromatic nitro group reduction, reductive dechlorination, and sulfoxide and N-oxide reductions.

80-2138. Shah, R. R.; Mehta, A. R. (All India Coord. Improve. Project Med. & Arom. Plants, Gujarat Agric. Univ., Anand 388110, India) **Effect of cycloheximide on phenolic production and formation of ammonia-lyases in callus cultures of *Crotalaria*.** *Sci. Cult.* 45(7): 280-283; 1979 (8 references).

Callus cultures derived from the seedlings of *Crotalaria juncea* were established on Murashige and Skoog's medium for over 3 yr. The medium was supplemented with 2.0 mg/l 2,4-D and varying concentrations of cycloheximide. Very strong inhibition of growth as well as the production of phenolic compounds was recorded at all levels of cycloheximide exposure. The inhibitory effect increased with increasing concentrations of cycloheximide. The developmental pattern of phenylalanine ammonia-lyase and tyrosine ammonia-lyase at various cycloheximide concentrations closely resembled that of controls. However, 54% and 36% inhibitions of phenylalanine ammonia-lyase and tyrosine ammonia-lyase, respectively, were recorded at low cycloheximide concentrations.

80-2139. Woodruff, H. B. (Merck Sharp & Dohme Res. Lab. Div., Merck & Co. Inc., Rahway, NJ 07065) **Natural products from microorganisms.** *Science* 208(4443): 1225-1229; 1980 (43 references).

Microorganisms are capable of producing natural products with widely divergent chemical structures. Greatest attention in the past has been paid to natural products that have antibiotic properties. Natural products accumulate in fermentation broths during secondary metabolism, a characteristic of the incomplete metabolic control operative in growth-inhibited microorganisms. With this general mechanism of biosynthesis, the natural products synthesized by microorganisms would be expected to have a broad range of pharmacological activities. The directed screening for non-antibiotic natural products has been of limited scope. The expectation that new compounds of interest would be found has been validated. The pharmacologically active natural products provide previously unrecognized structures as tools for fundamental research programs, as well as offering the possibility of direct use in medicine or in industrial processes. (Author abstract by permission. Copyright 1980 by the American Association for the Advancement of Science.)

80-2140. Tlaskal, J. (CSR Res. Lab., Roseville, New South Wales 2069, Australia) **Combined cycloheximide and 8-hydroxyquinoline pretreatment for study of plant chromosomes.** *Stain Technol.* 54(6): 313-319; 1979 (9 references).

In cytological studies, *Zea mays* root tips were pretreated with cycloheximide or 8-hydroxyquinoline) 8-quinolinol) alone or in combination prior to preparation for microscopic examination. The mitotic phase frequency (number of cells in a particular mitotic phase expressed as a percentage of the total number of cells classified) and the mitotic index (number of cells in mitosis/total number of cells) were determined. The combined treatment of cycloheximide (70 ppm) plus 8-hydroxyquinoline (250 ppm) was superior to either chemical separately in producing cells potentially useful for chromosome counting (cells with supercontracted chromosomes). After the combined treatment, the preparation contained nearly ten times more useful cells in prophase and metaphase than after a single pretreatment with 8-hydoxyquinoline alone. It is suggested that the supercontraction of chromosomes with cycloheximide, which is known to be a very fast acting and powerful inhibitor of protein synthesis, may be due to interference with the synthesis of specific proteins involved in the chromosome coiling cycle. It is also suggested that the inhibition of prophase by cycloheximide may be caused by its interference with the cellular energy transfer mechanism. It is pointed out that this new pretreatment will be useful for chromosome studies in a wide range of plant species.

80-2141. Bergen, J. D. (Pacific SW For. & Range Exp. Stn., For. Serv., USDA, Berkeley, CA) **Aerial spray pat-**

terns in a forest canopy. *Trans. ASAE* 22(6): 1279-1287; 1979 (16 references).

A model was designed and tested on two forest canopies to allow for greater precision in current forest herbicide spray programs. Level stands of Douglas fir and western larch were selected for spray distribution experiments. Results of the spray tests indicated the spray divided into 2 parts; one which was moved directly into the forest canopy by aircraft wake flows. The other was advected with the ambient winds and diffused above the canopy, in approximate accord with published models for elevated sources above rough surfaces. The amount of material in the ambient air in relation to that in the canopy increases with increased wind speed. A two-layer entrainment model was used to analyze the dosage pattern within the canopy for droplet sizes between 8 and 52 μm and between 52 and 140 μm. The entrainment coefficient appeared to vary quadratically with speed for smaller droplets, but linearly for larger droplets. It was estimated that a bulk interception coefficient varied approximately as the power of the speed.

80-2142. Tissut, M. (Lab. Physiol. Veg., Univ. Sci. & Med. Grenoble, Domaine Univ. Saint-Martin d'Heres, F-38041 Grenoble Cedex, France) **Penetration et transport des pesticides dans les vegetaux. [Penetration of pesticides into plants and their transport.]** *Trav. Soc. Pharm. Montpellier* 39(4): 259-274; 1979 (10 references) (French).

Pesticide penetration and transport in plants is discussed. The penetration of herbicides into plants is a prerequisite for their activity. Herbicides must pass through biological membranes to reach their targets such as chloroplasts, mitochondria or ribosomes. Fungicides usually require only contact with the plant surface, but some types such as benomyl act by a curative effect on mycelian development inside the plant. Pesticides need not penetrate into plants to affect voracious insects, but in the case of sucking insects penetration is indispensable. Penetration and transport frequently modify the structure of pesticides. Certain compounds accumulate in different parts of the plant. The anatomy of protection of higher plants, algae, mosses and lichens is described, and examples of penetration and transport of different herbicides in different plants are cited.

80-2143. Mitjavila, S.; Carrera, G.; Boigegrain, R. A. (Groupe Rech. Toxicol. Aliments Boissons, INSERM U-87, F-31400 Toulouse, France) **Aspects physicochimiques de l'interaction entre les pesticides et les milieux biologiques. [The physicochemical aspects of interaction between pesticides and biological media.]** *Trav. Soc. Pharm. Montpellier* 39(4): 289-305; 1979 (25 references) (French).

The physicochemical properties of pesticides, such as the chemical reactivity of molecules, transport across membranes, metabolization, ionization, the distribution coefficient, thermodynamic activity, the Hansch constant, the Hammet constant, polarity, and surface tension, are discussed. Pesticides are designed to interact with vital biological functions, with the specificity of the function determining the selectivity of the pesticide. This ideally should not affect the environment. Knowledge of the biochemical impacts of the physicochemical properties permits prediction of the biological activity of given pesticides and serves as a guide in conceiving new selective compounds with minimal unintended interaction with other species.

80-2144. Young, A. L.; Calcagni, J. A.; Thalken, C. E.; Tremblay, J. W. (Occup. & Environ. Health Lab., USAF, Brooks AFB, TX 78235) **The toxicology, environmental fate and human risk of Herbicide Orange and its associated dioxin.** *US NTIS AD Rep.* AD-A062,143: 247 pp.; 1978 (88 references).

The use of herbicides in South Vietnam between 1962 and 1971 was reviewed, including the nature and quantities of herbicides used, their handling and application. Emphasis was placed on Herbicide Orange, a 50:50 mixture of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4-trichlorophenoxyacetic acid (2,4,5-T), with its associated contaminant 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). The at risk US military population in South Vietnam was defined to establish the potential for exposure in handling and application of Herbicide Orange. The environmental fate of the phenoxy herbicides and TCDD was reviewed to evaluate the potential for human risk associated with exposure to areas previously treated with Herbicide Orange. The occupational and environmental aspects of the project to incinerate at sea 2.22 million gallons (8.4 million *l*) of Herbicide Orange during the summer of 1977 were summarized to assess the potential for human exposure in handling large quantities of the material. Scientific data were reviewed on incidents and episodes involving suspected poisoning of humans or animals by phenoxy herbicides or TCDD. Literature dealing with animal toxicology and the effects of human exposure to 2,4-D, 2,4,5-T and TCDD was reviewed to correlate exposures with symtomatology. (Author abstract by permission)

80-2145. Morey, P. R.; Dahl, B. E. (Dep. Biol., Texas Tech. Univ., Lubbock, TX 79409) **Inhibition of Mesquite *(Prosopis juliflora* var. *glandulosa)* growth by fosamine.** *Weed Sci.* 28(3): 251-253; 1980 (9 references).

Fosamine [ethyl hydrogen (aminocarbonyl) phosphonate] acted as a chemical inhibitor of shoot growth for periods of up to 3 yr following a single summer application to honey mesquite *[Prosopis juliflora* (Swartz) DC. var. *glandulosa* (Torr.) Cockerell] trees. Anatomical study of field, greenhouse, and seedling mesquite indicated that the inhibition of primary and secondary growth caused by fosamine was due to a general cessation of nuclear activity

in apical meristems and in the vascular and cork cambia of this species. (Author abstract by permission)

80-2146. Hatzios, K. K.; Penner, D. (Dep. Crop & Soil Sci., Pestic. Res. Cent., Michigan State Univ., East Lansing, MI 48824) **Site of uptake and translocation of ^{14}C-buthidazole in corn *(Zea mays)* and redroot pigweed *(Amaranthus retroflexus).*** *Weed Sci.* 28(3): 285-291; 1980 (11 references).

Uptake and translocation of ^{14}C-buthidazole 3-[5-(1,1-dimethylethyl) -1,3,4-thiadiazol- 2-yl] 4-hydroxy-1-methyl- 2-imidazolidinone in corn (*Zea mays* L.) and redroot pigweed (*Amaranthus retroflexus* L.) were studied following both foliar and root treatments under greenhouse and growth chamber environments. Following foliar application, ^{14}C-buthidazole was absorbed by the leaves of corn and redroot pigweed seedlings in similar amounts. Translocation occurred only toward the tip of the treated leaves in corn, whereas in redroot pigweed the ^{14}C moved both acropetally and basipetally. Rapid uptake by the roots and rapid movement to the leaves via the xylem seems to be the main pathway of uptake and translocation of ^{14}C-buthidazole supplied to the roots of redroot pigweed plants. Uptake by both the roots and the emerging coleoptile and transport to the foliage seems to be the pattern of absorption and translocation of buthidazole in corn following preemergence application. Differences in absorption did not appear to be an important factor contributing to selectivity of buthidazole between corn and redroot pigweed. However, translocation of ^{14}C-buthidazole supplied to the roots was faster to the redroot pigweed shoots than to corn shoots. (Author abstract by permission)

80-2147. Yamasue, Y.; Worsham, A. D. (Weed Sci. Lab., Fac. Agric., Kyoto Univ., Kyoto 606, Japan) **Effects of benefin vaporizing from soils on tobacco *(Nicotiana tabacum)* foliage.** *Weed Sci.* 28(3): 306-311; 1980 (18 references).

In closed vapor exposure chambers, foliar injury on tobacco (*Nicotiana tabacum* L. Speight G-28) seedlings was caused by vapors arising from soils in which technical grade benefin (benfluralin; *N*-butyl-*N*-ethyl-α,α,α-trifluro-2,6-dinitro-*p*- toluidine) or its commercially formulated emulsifiable concentrate had been incorporated. The emulsifier alone did not cause injury. Dosages of the herbicide ranged from 0.84 to 6.72 kg/ha or 13.1 to 104.8 ppmw in the concentration in soils, and the lowest dosage was sufficient to induce the foliar injury. Leaves which developed during the exposure were markedly shortened, narrowed and thickened, distorted in shape, and had an extremely poor lamina expansion and abnormal venation pattern. Severity of the foliar injury increased as the herbicide dosage and soil moisture increased, and as the soil organic matter content decreased. Leaves which were partially expanded before the exposure were affected much less. When exposed to vapors of ^{14}C-benefin, plant seedlings readily absorbed radioactive materials by its entire foliage including the stem tip with a few tiny developing leaves. More than half of the ^{14}C absorbed and adsorbed during a 3 day exposure was recovered by $CHCl_3$ wash of leaves and appeared to be retained by the wax and cutin layers, and also by lipoidal secretion substances of the numerous trichomes on the leaf surface. There was a small fraction of unabsorbed or loosely retained ^{14}C material on the surface of the leaves and stem tip, which was removed by water. That not recovered from H_2O and $CHCl_3$ washes appeared to be distributed in the internal tissues. Little acropetal translocation appeared to occur from the expanded leaves toward the stem tip. There was no translocation of ^{14}C-benefin into roots of plants where only a single leaf was exposed to the radioactive vapors. (Author abstract by permission)

80-2148. Haderlie, L. C. (Dep. Agron., Univ. Nebraska, Lincoln, NE 68583) **Absorption and translocation of buthidazole.** *Weed Sci.* 28(3): 352-357; 1980 (7 references).

Absorption and translocation of buthidazole {3-[5-(1,1-dimethylethyl) -1,3,4-thiadiazol- 2-yl]-4-hydroxy-1-methyl-2- imidazolidinone} was determined in several plant tissues. Buthidazole caused slight effects on seed germination. Germination of soybean *(Glycine max* L. Merr. Williams) seeds was inhibited up to 15% and velvetleaf *(Abutilon theophrasti* Medic.) was stimulated up to 13%. Buthidazole was absorbed by germinating soybeans, velvetleaf, and corn *(Zea mays* L.) with rate of absorption increasing when roots were capable of absorption. Buthidazole concentrations of 0.5 μM or greater inhibited growth of soybean in the early second-trifoliate growth stage when supplied to the roots in nutrient solution. Within 96 hr, 29% of the buthidazole available to soybeans was absorbed from nutrient solution and 89% of that absorbed was found in the shoots. The expanded leaves of soybean accumulated the majority of the radioactivity. Radioactivity in roots of soybean approached a steady state condition within 96 hr, whereas ^{14}C continued to increase in shoots. Foliar absorption of buthidazole in soybean greatly increased when any one of several surfactants. Over 60% of the ^{14}C-buthidazole applied to soybean leaves was absorbed within 1.5 hr, and increased to 73% by 96 hr when the nonionic surfactant, AL-411-F[3] [Phytobland Spray Oil (83%) plus ATPLUS 300F (17%)] was used compared to only 7% in 96 hr without the surfactant. There was little or no movement of buthidazole from the treated leaves. Translocation was typical of apoplastic movement. (Author abstract by permission)

80-2149. Castillo, S. V. L. (Fac. Land & Sea Sci., Natl. Univ., San Jose, Costa Rica) **Report on use of insecticides in country.** *Worldwide Rep. Epidemiol.* 182: 52-53; 1980.

The increased use of pesticides in Costa Rica over the past few years is discussed. Most of the increase has been used on crops such as cotton, bananas and coffee. Difficulties with the use of protective clothing during pesticide application, due to extremely high temperatures and elevated humidity of the country's tropical environment, are considered. This lack of protective devices suited to the climate, combined with ignorance of the toxicity of the chemicals being used, creates a large danger for the pesticide user. No effective control is exercised over the production, transportation, storage, sale or use of pesticides. Farmers of small land areas often receive small quantities of pesticides repackaged in containers carrying no labels, and all chances of recognizing the potential hazards are missed. It is conclude that appropriate control standards and techniques should be developed.

80-2150. Shariapanahi, M.; Anderson, A. C.; Abdelghani, A. A. (Sch. Public Health & Trop. Med., Tulane Univ., New Orleans, LA 70118) **Biodegradation of the herbicide MSMA.** *Abstr. Natl. Meet. Am. Assoc. Adv. Sci.* 146: 120; 1980.

Studies concerning the biodegradability of the organic arsenical herbicide monosodium methanearsonate (MSMA) are described. This compound is used for grass control in crops and along highway rights-of-way. Pure cultures of 7 bacterial species obtained from a treated site were used to determine the rate of degradation of the parent compound and the rates of production of each metabolite (arsonate, arsenite, and arsines). A biological half-life for MSMA was also determined. [Presented at the 146th National Meeting of the American Association for the Advancement of Science]

80-2151. Orndorff, S. A.; Colwell, R. R.* (Dep. Microbiol., Univ. Maryland, College Park, MD 20742) **Microbial transformation of Kepone.** *Appl. Environ. Microbiol.* 39(2): 398-406; 1980 (25 references).

Pseudomonas aeruginosa strain KO3 and a mixed aerobic enrichment culture, isolated from sewage sludge lagoon water, were found to aerobically transform the chlorinated insecticide Kepone (chlordecone), yielding monohydro-Kepone. Identification of the product was confirmed by gas chromatography and electron impact mass spectrometry. The mixed culture and *P. aeruginosa* strain KO3 produced about 4 and 16%, respectively, dihydro-Kepone, determined by cochromatography using authentic standards. Reduced amounts of monohydro-Kepone, compared with the mixed and pure cultures, were produced by James River sediment microorganisms. Kepone was not utilized as a sole carbon or energy source by any of the bacteria or mixed cultures examined in this study. (Author abstract by permission)

80-2152. Bollag, J. M.; Kurek, E. J. (Inst. Microbiol., Maria Curie-Skodowska Univ., Lublin, Poland) **Nitrite and nitrous oxide accumulation during denitrification in the presence of pesticide derivatives.** *Appl. Environ. Microbiol.* 39(4): 845-849; 1980 (12 references).

Temporary accumulation of nitrite and nitrous oxide was observed in soil incubated under anaerobic conditions when derivatives of the insecticide chlordimeform [(*N*-4-chloro-*o*- tolyl)-*N'*,*N'*- dimethylformamidine] dimethylformamidine] were added. Chlordimeform did not affect the denitrification process, but *N*-formyl-4-chloro- *o*-toluidine and 4-chloro-*o*-toluidine caused an inhibition as determined by the accumulation of nitrite and nitrous oxide. A simultaneous application of the insecticide and its derivatives resulted in a stronger inhibitory effect than the application of each compound separately. Aniline intermediates of other pesticides also inhibited denitrification in soil, and they proved to be more effective than their parent compound. (Author abstract by permission)

80-2153. Anderson, J. P. E.; Domsch, K. H. (Inst. Bodenbiol., Bundesforschungsanst. Landwirtsch., D-3300 Braunschweig, BRD) **Influence of selected pesticides on other microbial degradation of ^{14}C-triallate and ^{14}C-diallate in soil.** *Arch. Environ. Contam. Toxicol.* 9(1): 115-123; 1980 (18 references).

Degradation in soil of [allyl-2-^{14}C]trial^{1}ate and [carbonyl-^{14}C]diallate herbicides, as affected by other selected pesticides, was studied in an incubation system that allowed recovery of 95 to 100% of added ^{14}C. The amount and sequence of pesticide additions simulated field use in the protection of wheat (triallate) and sugar beets (diallate). Neither the rate nor the pattern of triallate degradation in soil was influenced by the following sequence of formulated pesticides: dinoseb acetate, bentazon + dichlorprop + 2,4,5-T, 2,4-D, chlorcholinchloride (CCC) + cholinchloride (chlormequat chloride), tridemorph, and thiophanate. Similarly, diallate degradation was unaffected by pyrazon (chloridazon), dimethoate, and thiophanate. The effect of azinphos-methyl was unclear. In contrast, chlorpyrifos reduced diallate degradation by approximately 14% relative to that occurring in the insecticide's absence. This effect was caused by chlorpyrifos and not its formulation components. Chlorpyrifos was also found to partially inhibit degradation of triallate in soil. Inhibition of neither herbicide was considered to be of ecological significance. Triallate, diallate, and thiophanate were applied at 1 μg/g; all others were at 2 μg/g.

80-2154. Uziak, S. (Dep. Pedol., Inst. Earth Sci., Univ. Marie Curie Sklodowskiej, Lublin, Poland) **Free amino acids in loess and sand soils treated with herbicides.** *Biul. Lubel. Tow. Nauk. Geogr.* 20(1): 19-23; 1978 (7 references).

Loess soil was treated with 4 and 40 l/ha Alipur (cyceuron + chlorbufam) in 1969 and 1.5 and 15 kg/ha 2,4-D in 1970. In sand soil in 1969, 2,4-D was applied at 1.5 and 15 kg/ha and in 1970 dicotex 40% (MCPA) was applied at 3 and 30 l/ha. Soil samples were taken before application of these herbicides and at 3, 10, 20, 30, 40, 60, 90, 120 and 150 days after application. Samples were taken from 0-10, 10-20, and 20-30 cm depths of soil. The content of free amino acids changed considerably in the soil genetic horizons in the vegetation periods. No relation was found among the total number of microorganisms, the use of herbicides, and the content of amino acids in the soil.

80-2155. Felsot, A.; Wilson, J. (Sect. Econ. Entomol., Illinois Nat. Hist. Surv., Urbana, IL 61801) **Adsorption of**

carbofuran and movement on soil thin layers. *Bull. Environ. Contam. Toxicol.* 24(5): 778-782; 1980 (9 references).

Seven agricultural soils were collected in Illinois. Samples of 20 g of soil were shaken with 100 ml of 20, 10, 5, 1 and 0 ppm carbofuran in 0.01 *M* calcium chloride for 6 hr. After centrifugation and extraction, carbofuran concentration was determined by spectrophotometry following base hydrolysis and coupling with *p*-nitrobenzenediazonium fluoborate. Adsorption of dieldrin was also measured. Carbofuran and dieldrin adsorptions were positively correlated with organic carbon content. Carbofuran was very mobile in the soils studied. On the silt loams and silty clay loams, carbofuran would fit into Helling's mobility class 3 or 4. Dieldrin was immobile on soil thin layers. Although about 2% of the applied dose of both dieldrin and carbofuran were lost in runoff, most dieldrin was associated with runoff of sediment while most of the carbofuran lost in runoff was associated with runoff water. This is discussed in light of the relationship between pesticide adsorption and mobility on soil thin layers.

80-2156. Zoeteman, B. C. J.; Harmsen, K.; Linders, J. B. H. J.; Morra, C. F. H.; Slooff, W. (Natl. Inst. Water Supply, NL-2260 AD Leidschendam, The Netherlands) **Persistent organic pollutants in river water and ground water of the Netherlands.** *Chemosphere* 9(4): 231-249; 1980 (34 references).

A review is presented of the problems of determining the persistence of chemicals in surface water and ground water. A definition is proposed for persistence of an aquatic pollutant. The main processes determining persistence in ground water and surface water (biological and chemical degradation, adsorption and precipitation, and volatilization) are described. Photochemical degradation is also discussed in relation to surface water. Some of the problems and advantages of field and laboratory studies for evaluation of persistence are described. The existing field data on chemicals in the aquatic environment in The Netherlands are reviewed. Compounds detected in ground and surface water are listed. Trichloromethane (chloroform) tribromoethane, trichloroethane, and tetrachloroethane (perchloroethylene) were found to be persistent in ground water. The half-lives of 78 compounds in surface waters were calculated, and the results are presented in tabular form. Compounds are classified according to differences in persistence. Of the compounds listed γ-HCH (γ-BHC, lindane), dieldrin and DDE were the most persistent, with half-lives > 300 days. Hexachlorobenzene was found to be one of the least persistent, with a half-life calculated to be 0.3-3 days in rivers. Hexachlorobutadiene showed a half-life of 3-30 days in rivers, and endosulfan 30-300 days in lakes and ground water. It is suggested that estimates from laboratory testing may result in a too optimistic prognosis for the persistence of a pollutant in surface water. More attention to field studies is recommended.

80-2157. Kuhr, R. J.; Hassan, A.; Winteringham, F. P. W. (Agric. Exp. Stn., Cornell Univ., Ithaca, NY 14853) **Carbamate insecticides. Comparative summary.** *Chemosphere* 9(4): 251-253; 1980 (23 references).

A brief review of the carbamate pesticides is presented. Usage trends indicate that these are important contact insecticides/acaricides, which are increasingly used as substitutes for organochlorine pesticides. The basic chemical structure of the parent compound is given along with 8 related pesticides [carbaryl, Baygon (propoxur), aminocarb, aldicarb, methomyl, Mobam, carbofuran and formetanate]. Residue composition, persistence, typical residues found following agricultural usage, toxicology, ecotoxicology and biological response data are discussed. Data indicate that these pesticides are non-persistent. Toxicity to mammals is characterized by reversible and normal-substrate competitive inhibition, resulting in cholinesterase inactivation with consequent cholinergic effects. Acute oral LD50 values for rats vary widely from 0.6 mg/kg for aldicarb to 500-850 mg/kg for carbaryl. Dermal toxicity also varies greatly. The acceptable daily limit of 0.01 mg/kg is given for carbaryl. Analytical procedures are also briefly outlined.

80-2158. Jennings, V. M.; Fenton, T. E. (Weed Sci. Dep., Iowa State Univ., Ames, IA 50010) **Influencing the action of herbicides. Soil texture, organic matter.** *Crops Soils* 32(8): 8-11; 1980.

The importance of soil characteristics such as organic matter content and soil texture in determining the effectiveness of a soil applied herbicide is discussed. Factors such as soil pH, soil moisture, soil temperatures and rainfall also determined how tightly a herbicide is held by the soil solids. A preemergence herbicide treatment is rendered extremely effective when application is followed by a gentle rainfall, moving the chemical into the upper 0.5 to 0.75 in. of soil. Other herbicides are actively incorporated into the soil to depths of up to 3 in. and are less dependent on subsequent rainfall. Herbicides establish an equilibrium between molecules of weed-controlling chemical attached to the organic matter of the soil and clay and the molecules in the soil solution or vapor phase. Herbicides which are present in the soil solution or vapor phase will be adsorbed by the weed seedling, thus causing more herbicide to be detached from soil particles.

80-2159. Leung, S. Y. T. (Iowa State Univ., Ames, IA) **The effect of impounding a river on the pesticide concentration in warmwater fish.** *Diss. Abstr. Int. B* 40(11): 5129; 1980.

Atrazine, alachlor, and Bladex (cyanazine) concentrations fluctuated seasonally in the dissolved fraction of the Des Moines River water from September, 1977 through November, 1978. These herbicides were not detected in the bottom sediment collected within Saylorville Reservoir and

in seven species of fish sampled above, within, and below the reservoir. The herbicides did not accumulate within the reservoir. Organochlorine insecticides dieldrin, heptachlor epoxide, *p,p'*-DDT, *p,p'*-DDE, and *p,p'*-DDD (TDE) were detected in most fish samples and bottom sediment. Only dieldrin and *p,p'*-DDE was found in both dissolved and suspended fractions of the river water. No discernible insecticide residue pattern was found in the water and fish in regard to time of the year. Classical biomagnification and spatial trend in concentration of insecticides were not noticeable in the fish. However, buildup of organochlorine insecticides within the reservoir has undoubtedly occurred. (Author abstract by permission. Copies of the thesis are available from University Microfilms, order No. 8010239)

80-2160. Zell, M.; Ballschmiter, K. (Abt. Anal. Chem., Univ. Ulm, D-7900 Ulm-Donau, BRD) **Baseline studies on the global pollution. II. Global occurrence of hexachlorobenzene (HCB) and polychlorocamphenes (toxaphene) (PCC) in biological samples.** *Fresenius Z. Anal. Chem.* 300(5): 387-402; 1980 (44 references).

Fishes have been used to characterize pristine aquatic environments. In samples from a lake in the Tyrolian Alps (arctic char) and Northwest Ireland (pike), the Caspian Sea (sturgeon/Sevruga), the North Atlantic (salmon), the North Pacific (salmon) and the Antarctic Ocean at South Georgia (antarctic cod) hexachlorobenzene and polychlorinated camphene (PCC, toxaphene) have been found. Samples are extracted by n-hexane/acetone (2 + 1), following a dimethylformamide/hexane clean-up of the lipid matrix. Adsorption chromatography on Florisil (1.25% water content) allows the elution of hexachlorobenzene, 4,4'-DDE and the polychlorobiphenyls (PCB) with n-hexane, while the mixture n-hexane/diethyl ether (90 + 10) will elute the polychlorocamphenes (PCC) together with the hexachlorocyclohexane (BHC) isomers and the DDT group. Identification of the PCC has been done by matching their retention indices measured by high resolution ECD glass capillary gas chromatography using the n-alkyl-trichloroacetates as references and technical toxaphene together with a slightly dehydrochlorinated product as authentic samples. The PCC content of the samples from the lakes in the European Alps and Northwest-Ireland, the North Pacific and the Antarctic Ocean was 125, 240, 285 and 68 ng of PCC per g of extractable lipids, respectively. The samples from the Caspian Sea and the North Atlantic had 1625 and 3500 ng of PCC per g of extractable lipids, respectively. All samples but the one from the Antarctic Ocean (liver) were spawn. Besides hexachlorobenzene and the PCC all samples contained polychlorobiphenyls (PCB), the α, β and γ-isomers of hexachlorocyclohexane, the compounds of the DDT-group and many other ECD-detectable not yet identified compounds. (Author abstract by permission)

80-2161. Plancher, B. (Inst. Pflanzenbau & Pflanzenzuecht. II, Obstbau & Obstzuechtung, Univ. Giessen, D-6300 Giessen, BRD) **Anmerkungen zur UV-Isomerisation der Abscisinsaure. [Notes on the isomerization of abscisic acid by irradiation with UV light.]** *Gartenbauwissenschaft* 44(4): 184-191; 1979 (9 references) (German).

Abscisic acid (ABA), a UV-light sensitive phytohormone, was irradiated in 10 and 100 ppm methanol solutions with UV light (254 nm) of 1.0, 2.1 and 4.6 mW/cm² intensity from 1 to 240 min, methylated, and the irradiation products were seperated by gas chromatography (GC). Irradiation products were then irradiated for a second time for 15 min and separated by TLC. An aliquote part of the eluate was methylated and also subjected to GC, which made it possible to compare TLC results with GC retention times. Irradiation of ABA resulted in isomerization *(cis,trans* and *trans,trans)*, the creation of artefacts (probably *cis,cis*-ABA, *trans,cis*-ABA, and ABA-epoxide) and the destruction of irradiation products. The results were more conspicuous with methylated ABA. The irradiation-induced attainment of a 1:1 ratio of *cis,trans*- and *trans,trans*-isomers reported in literature was not observed.

80-2162. Korolik, V. V. (N. I. Pirogov Med. Inst. II, Moscow, USSR) **Izuchenie svoistv shtammov *E. coli, S. typhimurium* i *C. perfringens*, vydelennykh iz pochvy, soderzhashche i bakterial'nye insektitsidy na osnove *B. thuringiensis*. [Study of properties of strains of *E. coli, S. thyphimurium*, and *C. perfringes* isolated from soil containing *B. thuringiensis* insecticides.]** *Gig. Sanit.* 45(4): 77-78; 1980 (6 references) (Russian).

The effect of bacterial insecticides (*Bacillus thuringiensis*; Entobacterin and Dendrobacillin) on some properties of indicator soil bacteria was evaluated. Repeated inoculation (every 10 days) of soil with viable spores of *B. thuringiensis* resulted in marked decrease of enzymatic activity and some decrease of virulent activity of *E. coli* and *S. typhimurium*. Activity of *C. perfringens* was not changed.

80-2163. Ruzo, L. O.; Gaughan, L. C.; Casida, J. E. (Pestic. Chem. & Toxicol. Lab., Dep. Entomol. Sci., Univ. California, Berkeley, CA 94720) **Pyrethroid photochemistry: *S*-bioallethrin.** *J. Agric. Food Chem.* 28(2): 246-249; 1980 (17 references).

Photodecomposition of *S*-bioallethrin, the 1*R*,3*R*,4,5'*S* isomer of the insecticide allethrin, in the solid phase or in solution by sunlight or ultraviolet light (λ 360 nm) yields the following major products at < 50% conversion: *cis*-allethrin, the di-π-methane rearrangement product at the allyl substituent, the allylic alcohol and epoxides from the isobutenyl group, and chrysanthemic acid. Triplet intermediates are involved in the cyclopropane isomerization reactions and the di-π-methane rearrangement, with the latter process predominating. The yield of epoxides formed by triplet oxygen is considerably enhanced with benzil as a mediator. Oxidation at the allylic position of the

chrysanthemate moiety results from radical reactions of ground-state oxygen. Many other products obtained in low yields (<1%) presumably arise from further reactions of the primary photoproducts. (Author abstract reprinted by permission of the American Chemical Society)

80-2164. Mrlina, G.; Calmon, J. P.* (Lab. Chim. Org. Biol. & Physicochim. Sol, Ec. Natl. Super. Agron., F-31076 Toulouse Cedex, France) **Kinetics and mechanism of hydrolysis of insecticidal *O*-(methylcarbamoyl) oximes.** *J. Agric. Food Chem.* 28(3): 605-609; 1980 (28 references).

The hydrolysis of various insecticidal benzaldoxime and acetophenoxime carbamates was investigated for hydroxide ion concentrations ranging from 0.01 to 5.0 *N* at 25°C. The reactions were found to be first order with respect to both hydroxide ion and the ester. The data suggest the involvement of an E1cB elimination mechanism with formation of an isocyanate intermediate. The Hammett ϱ values were different from those usually reported for such a reaction scheme since the imine bond weakens the substituent effects. (Author abstract reprinted by permission of the American Chemical Society)

80-2165. Cliath, M. M.; Spencer, W. F.; Farmer, W. J.; Shoup, T. D.; Grover, R. (Univ. California, SEA, USDA, Riverside, CA 92521) **Volatilization of *S*-ethyl *N,N*-dipropylthiocarbamate from water and wet soil during and after flood irrigation of an alfalfa field.** *J. Agric. Food Chem.* 28(3): 610-613; 1980 (18 references).

The herbicide *S*-ethyl *N,N*-dipropylthiocarbamate (EPTC) was applied to alfalfa in irrigation water. The actual vapor loss rate was assessed using an aerodynamic technique to estimate the EPTC vapor flux from the field during and after 2.19 ppm EPTC was applied by flood irrigation. The EPTC vapor flux 59.5 cm above the field varied from 37 to 259 g/ha/hr while surface water was present. The EPTC vapor flux values measured over wet soil after irrigation ranged from 2 to 103 g/ha/hr and was highest at night. Of the 3.04 kg/ha EPTC applied, 7.0% was removed in tailwater runoff and 73.6% volatilized during the 52 hr of observation. This indicates that using surface irrigation water to apply EPTC to alfalfa is an inefficient method. (Author abstract reprinted by permission of the American Chemical Society)

80-2166. Nash, R. G.; Beall, M. L., Jr. (Pestic. Degradat. Lab., Agric. Environ. Qual. Inst., Agric. Res., SEA, USDA, Beltsville, MD 20705) **Distribution of silvex, 2,4-D, and TCDD applied to turf in chambers and field plots.** *J. Agric. Food Chem.* 28(3): 614-623; 1980 (18 references).

The fate of 1.3 kg of granular 2,4-D [(2,4-dichlorophenoxy) acetic acid] per ha, 2.8 kg of granular and 2.0 kg of emulsifiable silvex [2-(2,4,5-trichlorophenoxy) propionic acid] per ha, and a possible toxic contaminant of silvex, TCDD (2,3,7,8-tetrachlorodibenzo-*p*-dioxin), applied to bluegrass (*Poa pratensis* L.) turf were determined in four components (grass, soil, water, and air) of microagroecosystem chambers. Residue half-concentration times ($c_{1/2}$) for silvex on soil were 35 days for both formulations and 10 days for granular 2,4-D. TCDD concentrations in leachate water were $< 10^{-16}$ and 10^{-13} g/g water after silvex applications containing 44 ppb and 7.5 ppm TCDD, respectively. Air concentrations of silvex and 2,4-D were in the ng/m^3 range and TCDD in the femtogram/m^3 (10^{-15} g/m^3) range, being ca. 100-fold less initially for the granular. Residue $c_{1/2}$'s in air were 11 and 15 days for emulsifiable and granular silvex, respectively, 14 days for granular 2,4-D, and 24 days for the emulsifiable TCDD formulations. TCDD seems to dechlorinate in the vapor phase both indoors and outdoors. (Author abstract reprinted by permission of the American Chemical Society).

80-2167. Wahid, P. A.; Sethunathan, N.* (Coll. Hortic. Vellanikara, Trichur, Kerala, India) **Sorption-desorption of lindane by anaerobic and aerobic soils.** *J. Agric. Food Chem.* 28(3): 623-625; 1980 (15 references).

In a study on the sorption of pesticides by 3 soils, soils prereduced by flooding sorbed less lindane (γ-hexachlorocyclohexane) than aerobic soils. This difference was particularly striking in the soil with lowest organic matter content and was probably masked in the other 2 soils by higher organic matter content. The decreased sorption of lindane by anaerobic soils low in organic matter content is attributed to the decrease in inorganic surface area caused by the reduction of ferric to ferrous ion and the high state of hydration attained by ferric oxides upon flooding. Desorption of lindane was not affected by soil anaerobiosis. (Author abstract reprinted by permission of the American Chemical Society)

80-2168. Lavy, T. L.; Shepard, J. S.; Mattice, J. D. (Dep. Agron., Altheimer Lab., Univ. Arkansas, Fayetteville, AR 72701) **Exposure measurements of applicators spraying (2,4,5-trichlorophenoxy) acetic acid in the forest.** *J. Agric. Food Chem.* 28(3): 626-630; 1980 (15 references).

Personnel normally involved with spray applications in the forest were monitored for exposure to (2,4,5-trichlorophenoxy)acetic acid (2,4,5-T). Seven members of a backpack crew, four from a tractor crew, and two 5-man helicopter crews assisted in this study. Crews followed usual spray routines with as little influence as possible from the test. External dermal and respiratory exposures were measured, and total intake of 2,4,5-T was determined from the total urine collected from each worker for a 6-day period. Analyses by gas chromatography showed that the degree of exposure was related to worker's job. Greatest

amounts were detected in mixers of the compound and least amounts in helicopter flagmen. Exposure to 2,4,5-T averaged 0.0005, 0.586, and 0.033 mg/kg body wt for inhalation, patch, and internal measurements, respectively. These measurements indicate that the worker excreting the highest amount of 2,4,5-T received exposure levels below those toxic to laboratory animals. (Author abstract reprinted by permission of the American Chemical Society)

80-2169. Kearney, P. C.; Oliver, J. E.; Kontson, A.; Fiddler, W.; Pensabene, J. W. (Pestic. Degradat. Lab., Agric. Res., SEA, USDA, Beltsville, MD 20705) **Plant uptake of dinitroaniline herbicide-related nitrosamines.** *J. Agric. Food Chem.* 28(3): 633-635; 1980 (8 references).

Field experiments were conducted on the uptake and translocation of ^{14}C-labeled *N*-nitrosodipropylamine (NDPA, an impurity found in the herbicide trifluralin) and *N*-nitrosopendimethalin (NP, found in the herbicide pendimethalin) in soybeans grown in Matapeake silt loam amended with labeled NDPA and NP. Soils, beans, and plant parts were combusted to determine total ^{14}C and were also extracted and/or steam distilled. Extracts and distillates were analyzed for nitrosamines by a thermal energy analyzer (TEA) and for labeled materials by thin-layer chromatography-autoradiography and liquid scintillation. Residues of NP and NDPA in beans were not detected by ^{14}C or TEA. No ^{14}C residues from NDPA were detected in other plant parts. Low levels of ^{14}C were found in plants grown in NP amended soil; however, residues of NP were not identified. (Author abstract reprinted by permission of the American Chemical Society)

80-2170. Weete, J. D.; Pillai, P.; Davis, D. D. (Dep. Bot. & Microbiol., Agric. Exp. Stn., Auburn Univ., Auburn, AL 36830) **Metabolism of atrazine by *Spartina alterniflora*. 2. Water-soluble metabolites.** *J. Agric. Food Chem.* 28(3): 636-640; 1980 (9 references).

Roots of *S. alterniflora* plants were exposed to ring-labeled [^{14}C]atrazine for 2 days and then transferred to an atrazine-free nutrient solution and sampled 3, 8, 18, and 28 days after transfer. Radioactivity in the aqueous fraction of 80% methanol extracts of shoots from these plants ranged from *ca.* 58 to 60% of that in the total extract during 8-28 days transfer. Fourteen water-soluble metabolites of atrazine were isolated using cation- and anion-exchange and Sephadex column chromatography and thin-layer chromatography. About half the substances contained fully N-alkylated triazine rings and most of the others contained the 4-amino-6-isopropylamino derivative. Only one metabolite contained the 4-amino-6-ethylamino derivative, and no 4,6-diamino forms were detected. 2-Hydroxyatrazine and 2-hydroxy-4-amino- 6-(isopropylamino) -*s*-triazine were also identified. Acid hydrolysates of the metabolites contained low amounts of amino acids such as glutamic acid, glycine, and valine, suggesting a conjugation pathway of atrazine metabolism may be operative in *Spartina*, such as glutathione conjugation that occurs in *Sorghum*. (Author abstract reprinted by permission of the American Chemical Society)

80-2171. Lusby, W. R.; Oliver, J. E.; Kearney, P. C. (Pestic. Degradat. Lab., Agric. Res., SEA, USDA, Beltsville, MD 20705) **Metabolism of 2,6-dinitro-4-(trifluoromethyl) benzenamine by a *Streptomyces* isolated from soil.** *J. Agric. Food Chem.* 28(3): 641-644; 1980 (10 references).

Several dinitroaniline herbicides are *N,N*-dialkyl derivatives of 2,6-dinitro-4-(trifluoromethyl)benzenamine. 2,6-Dinitro-4-(trifluoromethyl[*ring*-^{14}C]benzenamine (I) was metabolized to several products by a *Streptomyces* sp. isolated from soil. Metabolites were separated by dry column chromatography, purified by high-pressure liquid chromatography, and identified by chemical ionization and electron impact mass spectral analysis and infrared spectroscopy. Products identified were I, 3-nitro-5-(trifluoromethyl)-1,2-benzenediamine (II), *N*-[2-amino-5-(trifluoromethyl)phenyl] acetamide (III), *N*-[2-amino-3-nitro-5-trifluoromethyl)phenyl] methanesulfinamide (V), a diphenyldiazene (VI), and a diphenyldiazene oxide (VII). (Author abstract reprinted by permission of the American Chemical Society)

80-2172. Singmaster, J. A., III (Agric. Exp. Stn., Univ. Puerto Rico, Rio Piedras, Puerto Rico) **Residue analysis of endosulfan in pigeon peas.** *J. Agric. Univ. P. R.* 64(2): 219-231; 1980 (10 references).

Pigeon peas were exposed to endosulfan at rates of 0.56 and 1.12 kg AI/ha. Two applications were made 8 days apart. The total residue measured among 6 machine-shelled samples, picked 6 hr after the last application at the 0.56 kg/ha rate, ranged from 0.61 to 1.10 ppm. A similar analysis, performed after the application of endosulfan at 1.12 kg AI/ha, indicated a residue range of 1.4 to 2.3 ppm. Five days after the second treatment the residue range at the lower concentration was 0.07 to 0.11 ppm, and at the higher concentration the range was 0.13 to 0.33 ppm.

80-2173. Bowman, B. T.; Sans, W. W. (Res. Inst., Canada Agric., London, Ontario N6A 5B7, Canada) **Stability of parathion and DDT in dilute iron solutions.** *J. Environ. Sci. Health B* 15(3): 233-246; 1980 (14 references).

Ferric chloride and ferric nitrate were examined for their ability to catalyze parathion breakdown in aqueous solutions. Some of the hydrolysis products were more active than ferric ion in catalyzing parathion degradation. Acidity (pH) did not seem to be a factor in the degradation capabilities of the iron solutions. Parathion breakdown

seemed to be concentration dependent. This was difficult to determine since there were several iron hydrolysis reactions which produced interrelated hydrolyzed iron species. The observed rate constant was a summation of the individual rate constants observed. The predominant reduction pathway in dilute ferric ion solutions was oxidation to paraoxon. Further hydrolysis, of parathion or paraoxon to *p*-nitrophenol, occurred at much slower rates. In other experiments, aluminum chloride did not catalyze parathion degradation and DDT breakdown was not catalyzed by iron or its hydrolysis products in aqueous solutions.

80-2174. Anderson, A. C.; Abdelghani, A. A.; Hughes, J.; Mason, J. W. (Dep. Environ. Health Sci., Sch. Public Health & Trop. Med., Tulane Univ., New Orleans, LA) **Accumulation of MSMA in the fruit of the blackberry (*Rubus* sp.).** *J. Environ. Sci. Health B* 15(3): 247-258; 1980 (9 references).

Uptake and concentration of MSMA in blackberries gathered during stages of maturation after the recommended application of 3.37 kg MSMA/ha indicated that arsenic levels were present at the earliest stages of fruit development. These levels increased to concentrations of 25-30 μg/g during the week immediately following application of the herbicide to the green fruits. During later stages of development concentration reached 12.5 μg/g in red and ripe fruit. Arsenic appears to concentrate in the berries themselves after topical applications to berries and from translocation from stems and leaves. The greatest potential hazard to humans occurs when MSMA is used on the red or ripened fruits.

80-2175. Bedi, S.; Roy, N. K. (Div. Agric. Chem., Indian Agric. Res. Inst., New Delhi 110012, India) **Metabolism of *O,O*-diphenyl dichloromethyl phosphonate by mycelial cells of *Pyricularia oryzae*, Cav.** *J. Environ. Sci. Health B* 15(3): 259-265; 1980 (6 references).

The degradation of *O,O*-diphenyl dichloromethyl phosphonate (a rice fungicide) by microorganisms was studied and compared to rice plant degradation of the chemical. Mycelia of *Pyricularia oryzae*, Cav. were used as the test organisms. Metabolism of the chemical occurred by hydrolytic cleavage of one ester linkage followed by cleavage of the other ester linkage yielding dichloromethyl phosphonic acid as an end product.

80-2176. Osman, M. A.; Belal, M. H. (Fac. Agric., Cairo Univ., Giza Egypt) **Persistence of carbaryl in canal water.** *J. Environ. Sci. Health B* 15(3): 307-311; 1980 (6 references).

An irrigation and drainage canal in Giza, 70 cm wide and 25 cm deep, was sprayed with 1 ℓ of an 85% solution of 1000 mg carbaryl. Water samples were collected daily from the sprayed area and from the end of the canal. The samples were mixed and analyzed for carbaryl and any degradation products by thin layer chromatography (TLC). IR and UV spectrophotometry were used to confirm the identities of the extracted compounds. Carbaryl was present in the water up to day 6 after spraying. A degradation product, 1-naphthol, was identified and was also present in the canal up to day 6. The results of the study are in agreement with other investigations on the disappearance of carbaryl from flowing waters.

80-2177. Osborn, D. (Inst. Terr. Ecol., Monks Wood Exp. Stn., Cambridgeshire PE17 2LS, England) **Pesticides and British wildlife: brief review of some recent work at Monks Wood.** *J. R. Soc. Med.* 73(2): 127-130; 1980 (21 references).

Recent work at the Monks Wood Experimental Station is reviewed. During the first phase of the work the extent of the pesticide wildlife problem was established and the complexity of the situation understood. It was determined that dieldrin and other organochlorine insecticides caused sudden declines in birds of prey populations around 1960. DDT caused declines in population which lasted longer due to the fact that DDT disrupted breeding. Embryo deaths were caused by high levels of PCBs in birds of prey eggs. DDT, dieldrin, PCBs, mercury and cadmium were frequently found in tissues of field mice, otters, terrestrial birds of prey, coastal sea ducks and pelagic sea birds. A group, investigating the effects of organochlorine insecticides, reported hormone levels changed in paired pigeons and altered breeding behaviors. Research on the relation of pesticide levels on seasonal changes in the animals' physiology is being conducted.

80-2178. Currier, M. F.; McClimans, C. D.; Barna-Lloyd, G. (Med. Dep., Louisiana Div., Dow Chemical, Plaquemine, LA) **Hexachlorobenzene blood levels and the health status of men employed in the manufacture of chlorinated solvents.** *J. Toxicol. Environ. Health* 6(2): 367-377; 1980 (26 references).

The results of 4 yr of monitoring hexachlorobenzene (HCB) levels in the plasma or blood of employees involved with chlorinated solvents in a chemical manufacturing plant are reported. In general their medical histories and physical examinations revealed nothing remarkable about these employees. No cutaneous or hepatic changes were noted which would be suggestive of porphyria cutanea tarda. HCB values ranged from 5 to 1121 ppb in 1974; from 30 to 990 in 1975; from 3 to 600 in 1976 and from 22 to 467 ppb in 1977. Airborne HCB exposure concentrations ranged between < 1 and 13 ppb during the study period. It is noted that the blood levels of HCB were strongly associated with the number of years worked in the chlorinated solvents plant, but were poorly correlated with environmental measurements.

80-2179. Engstrom-Heg, R.; Colesante, R. T. (Author address not given) **Predicting rotenone degradation in lakes and ponds.** *N Y Fish Game J.* 26(1): 22-36; 1979 (9 references).

Rotenone degradation rates in natural lake water were determined by suspending rotenone solutions in clear and opaque plastic bags at different depths of an oligotrophic lake in New York State. Rate constants for all deep, surface, and epilimnetic samples in the opaque bags were logarithmically related to temperature, with slower degradation than had been reported in previous experiments. Detoxification was dependent on light and decomposition of rotenone in surface samples. In clear bags results in agreement with previous degradation findings were obtained. Detoxification times were calculated by equations to estimate safe treatment schedules to avoid contamination of fish in lakes and ponds in the Fall under various conditions.

80-2180. Yasuda, H. (Matsuyama Tech. High Sch., Matsuyama 790, Japan) **[Concentration of organic phosphorus pesticides in the atmosphere above the Dogo Plain and Ozu Basin.]** *Nippon Kagaku Kaishi* 8(4): 645-653; 1980 (4 references) (Japanese).

In July, August and September of 1976 the pesticides IBP, MEP (fenitrothion), and diazinon were highly concentrated in the atmosphere above the Dogo Plain and the Oxu Basin in Japan. This corresponded to the large amount of pesticides applied to rice fields during this same time period. The residual index was smaller than that of BHC and decreased in the order diazinon, IBP, and MEP. The fluctuation coefficient changed to the order IBP, MEP, and diazinon. The concentration of IBP in the atmosphere after spray reached 37.3 $\mu g/m^3$, which decreased to 61 ng/m^3 after 100 hr.

80-2181. Moreale, A.; Van Bladel, R. (Fac. Sci. Agron., Dep. Sci. Sol, Univ. Cathol., Louvain, Belgium) **Adsorption et migration du lindane (1,2,3,4,5,6-hexachlorocyclohexane) dans les sols. [Adsorption and leaching of lindane in soils.]** *Parasitica* 34(4): 233-255; 1978 (33 references) (French).

The adsorption of lindane was studied on 42 soil samples. A major portion of the insecticide appears to be adsorbed by soil colloids, particularly by organic matter and clay. Predictions of the adsorption of lindane onto soil can be made more exact when the soil is definitely classified as sandy, loamy sand, or silty. Lindane was adsorbed in amounts ranging from 0.1 to 6 ppm. A very high proportion of the chemical was irreversibly bound at the adsorption sites, particularly in soils with a high organic or clay content. This suggests high residues of lindane can be found in the top horizons of the soil profile. Interaction between lindane and soil colloids was practically instantaneous. The degree to which lindane penetrated the soil layer was dependent on the volume of water percolating through the soil columns, the colloid content of the soil, the solubility limit of lindane, and the porous structure of the soil sample.

80-2182. Vonk, J. W.; Quirijns, J. K. (Inst. Org. Chem. TNO, NL-3502 JA Utrecht, The Netherlands) **Anaerobic formation of α-hexachlorocyclohexane from γ-hexachlorocyclohexane in soil and by *Escherichia coli*.** *Pestic. Biochem. Physiol.* 12(1): 68-74; 1979 (12 references).

Two different types of soil, a sandy loam and a silt loam, were treated with γ-hexachlorocyclohexane (γ-BHC, lindane). The final concentration of the chemical in the soils was 7.5 mg/kg. Some soil samples were kept under aerobic conditions and incubated at 24°C in a moist box. Other samples were kept under submerged conditions with 50 ml water added to the sample. Incubation for these latter soils was carried out at 24°C in the dark. The submerged soils became largely anaerobic after a short period. Detectable amounts of α-BHC were found in the submerged samples after a 4 wk incubation period. After 8 wk the concentrations of α-BHC were 14 and 4 μ/kg in the sandy loam and silt loam, respectively. A major conversion product under aerobic conditions was γ-PCCH. γ-TCCH was a major product in the submerged samples. Upon anaerobic incubation growing cultures of *Escherichia coli* produced α-BHC from the γ-isomer. Growing mycelia of *Aspergillus niger* incubated with γ-BHC produced no α-isomer.

80-2183. Gray, T. G.; Jones, J. G.; Wright, S. J. L. (Dep. Biol., Univ. Essex, Colchester, England) **Microbiological aspects of the soil, plant, aquatic, air and animal environments.** In: *Pesticide Microbiology*. Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH02): 17-77; 1978 (197 references).

Information is presented on the composition and microbiology of environments in which pesticides and microbes interact. The biological processes of soil microorganisms may be altered by fungicides and other pesticides. The characteristics of a soil may change due to alterations within the microbial community due to the use of pesticides. Soil microorganisms are important in processes of soil nitrification and aeration and moisture and pH regulation. The uptake of soil-applied pesticides by plants may also affect leaf-sucking organisms. A description of marine, estuarine, and freshwater lentic and lotic environments is given along with the microbial ecosystems present in each. The characteristics of the atmosphere and its microbial content are discussed. Animals as microbial life hosts are considered, and the interactions of microorganisms with vertebrate and invertebrate species are covered.

80-2184. Hill, I. R.; Wright, S. J. L. (Imperial Chem. Ind., Plant Prot. Div., Jealott's Hill Res. Stn., Bracknell,

Berkshire, England) **The behaviour and fate of pesticides in microbial environments.** In: *Pesticide Microbiology*. Hill, I. R. and Wright, S. J. L, eds. (Academic Press: London) (CH03): 79-136; 1978 (251 references).

The entry, dispersal, and ecological effects of pesticides in the soil, aquatic, and atmospheric environments are discussed in relation to the microbiota. The transformation of pesticides by soil microorganisms and aerial transformation processes are considered. The actions of aerially applied pesticides on plant surfaces are mentioned, and pesticide entry and dispersal in animal systems are covered. Pesticidal interactions with animals and with microbes associated with animals are also investigated.

80-2185. Hill, I. R. (Imperial Chem. Ind., Plant Prot. Div., Jealott's Hill Res. Stn., Bracknell, Berkshire, England) **Microbial transformation of pesticides.** In: *Pesticide Microbiology*. Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH04): 137-202; 1978 (346 references).

Pesticide transformations are often necessary in the environment to achieve safe limits of these compounds after their desired effect has been obtained. The terminology of pesticide transformation is defined and the potential of microorganisms for bringing about pesticide transformations is examined. The biological, physical and chemical factors affecting environmental pesticide transformations are considered. β-oxidation, oxidative dealkylation, thioether oxidation, decarboxylation and epoxidation are among the various methods used by microorganisms for the transformation of pesticidal compounds. Aromatic non-heterocyclic and heterocyclic ring cleavages are also found during microbial transformations of pesticides. Pesticides are also transformed by microorganisms through halogen reactions, hydrolysis and nitro-reductions. Other less frequent pesticide transformation reactions are mentioned.

80-2186. Hill, I. R.; Arnold, D. J. (Imperial Chem. Ind., Plant Prot. Div., Jealott's Hill Res. Stn., Bracknell, Berkshire, England) **Transformations of pesticides in the environment – the experimental approach.** In: *Pesticide Microbiology*. Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH05): 203-245; 1978 (128 references).

The environmental transformation of pesticides has been a difficult field of study. *In vitro* experiments on pesticidal transformation are outlined and methods for microorganism isolation and culture maintenance are discussed. Studies of pesticide transformations in natural environments through biological and chemical means are considered. Transformations in soil, aquatic, plant/soil and other microbial systems are examined. The analysis of pesticide transformation products is mentioned. Soil studies involving pesticide transformation in the field and in the laboratory in the absence and presence of plants are also presented.

80-2187. Anderson, J. R. (Microbiol. Unit., Natl. Food Res. Inst., C.S.I.R., Pretoria, South Africa) **Some methods for assessing pesticide effects on non-target soil microoorganisms and their activities.** In: *Pesticide Microbiology*. Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH06): 247-312; 1978 (190 references).

Some problems of testing the effects of pesticides on non-target soil microorganisms are presented. Methods for enumerating soil microorganisms and for measuring growth rates and distribution of microbes are examined. The activity of the soil microbial biomass may be assessed by methods of respirometry and microcalorimetry. The rate of substrate change is studied along with the effect of pesticides on soil enzymatic activity. Root-microbe and leaf microbe associations are also discussed in relation to pesticide applications.

80-2188. Anderson, J. R. (Microbiol. Unit., Natl. Food Res. Inst., C.S.I.R., Pretoria, South Africa) **Pesticide effects on non-target soil microorganisms.** In: *Pesticide Microbiology*. Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH07): 313-533; 1978 (549 references).

Factors which influence the effects of pesticides on non-target soil organisms are reviewed. They include variations in the soil, agronomic techniques, vegetation cover, laboratory methods, and pesticide type, formulation and method of application. The effects of herbicides, fungicides, insecticides, soil fumigants, and other compounds on non-target soil microorganisms are discussed. Some general consequences of pesticides use are also summarized.

80-2189. Wright, S. J. L. (Sch. Biol. Sci., Univ. Bath, Bath, England) **Interactions of pesticides with micro-algae.** In: *Pesticide Microbiology*. Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH08): 535-602; 1978 (230 references).

The uptake, accumulation and metabolism of pesticides by micro-algae is examined with emphasis on algal degradation of aromatic compounds, insecticides, fungicides algicides, and herbicides. The effects of insecticides, herbicides, fungicides, and antibiotics on micro-algae are studied, and the control of problem algae is discussed. The use of micro-algae for pesticide bioassays in agar plate and liquid media, and in soil and solid substrates is also investigated.

80-2190. Edwards, C. A. (Rothamsted Exp. Stn., Harpenden, Hertfordshire, England) **Pesticides and the micro-fauna of soil and water.** In: *Pesticide Microbiology*. Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH09): 603-622; 1978 (94 references).

Various techniques for studying the effects of pesticides on soil and water micro-fauna are examined.

Field studies are often more difficult than laboratory assays for the assessment of pesticidal effects on soil and aquatic microbes. Respiration and organic matter breakdown are given as examples of indirect methods used to study the effects of pesticides on aquatic and soil micro-fauna. Both direct and indirect pesticide effects on soil and water microorganisms are discussed. Pesticidal uptake by soil and aquatic micro-fauna is also considered.

80-2191. Matsumura, F.; Benezet, H. J. (Dep. Entomol., Univ. Wisconsin, Madison, WI) **Microbial degradation of insecticides.** In: *Pesticide Microbiology.* Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH10): 623-667; 1978 (134 references).

Many natural forces are present in the environment which alter the composition of pesticidal compounds. Some of the chemical characteristics of insecticides are reviewed and the basic enzymatic and non-enzymatic processes of microbial metabolism are mentioned. The hydrolytic, reductive and oxidative processes of microorganisms used during insecticide metabolism are explained along with related metabolic reactions of insecticide degradation. Microbial metabolism of the chlorinated hydrocarbon, organophosphorus and carbamate insecticides and other miscellaneous insecticides is also examined.

80-2192. Cripps, R. E.; Roberts, T. R. (Shell Res. Ltd., Woodstock Lab., Sittingbourne Res. Cent., Sittingbourne, Kent, England) **Microbial degradation of herbicides.** In: *Pesticide Microbiology.* Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH11): 669-730; 1978 (173 references).

Biodegradation studies have provided insight into the nature of pesticide metabolism. The degradation of herbicides by microorganisms is extensively reviewed. The acylanilides, phenylcarbamates, phenylureas and herbicide-derived anilines are among the phenylamides covered. Microbial degradation processes of the *s*-triazines, benzoic acid herbicides, chlorinated aliphatic acids, bipyridyls and dinitroaniline herbicides are examined. The microbial decomposition of the pyrazon (chloridazon), endothal, pentachlorophenol (PCP) and pronamide herbicides are also considered.

80-2193. Woodcock, D. (Res. Stn., Univ. Bristol, Long Ashton, Bristol, England) **Microbial degradation of fungicides, fumigants and nematocides.** In: *Pesticide Microbiology.* Hill, I. R. and Wright, S. J. L., eds. (Academic Press: London) (CH12): 731-780; 1978 (83 references).

Fungicides may be divided into eradicants, protectants or systemic agents according to their mode of action. These major pesticide categories are studied in relation to their degradation by microorganisms. Microbial degradation of common fumigants and nematocides is also reviewed. Some aliphatic compounds, organomercurials, organosulfur compounds, quinones, aromatic compounds and heterocyclic compounds are among the soil-applied chemicals and seed protectants whose microbial degradation is examined. The microbial degradation of organotin and aromatic protectant fungicides is also reviewed. Organophosphorus, aromatic, heterocyclic and aliphatic compounds and some antibiotics are included in the discussion of microbial degradation of systemic fungicides.

80-2194. Pank, F.; Hannig, H. J.; Hauschild, J.; Zygmunt, B. (Versuchsstn. Arznei & Gewuerzpflanzenproduktion VEB, Bernberg, DDR) **Chemische Unkrautbekaempfung in Arzneipflanzenkulturen. 1 Mitteilung: Baldrian (2aleriana officinalis L.). [Chemical weed control in the cropping of medicinal plants. Part 1: Valerian (2aleriana officinalis L.).]** *Pharmazie* 35(2): 115-119; 1980 (15 references) (German).

Forty herbicides were field tested on *Valeriana officinalis* crops. Herbicides found to be strongly phytotoxic at the 15-25 cm growth stage were atrazine, chlorbromuron, chloroxuron, dalapon, dichlorprop, dinoseb, dinoseb acetate, diquat, diuron, DNOC, fenuron, linuron, mecoprop, paraquat, pentanochlor, phenmedipham, prometryne + simazine, and chloropropham + propazine. Chlorpropham residues in *Valeriana* samples after application at 4 kg/ha were < 0.05 mg/kg in 9 of 12 samples, and 0.40, 0.60 and 1.00 mg/kg in the remaining 3 samples. Metabromuron applied at 2 or 3 kg/ha gave 0.04-0.14 mg/kg residues in 9 of 12 samples. Three samples contained no residues. Nitrofen residues found in 16 samples ranged from < 0.005 to 0.158 mg/kg after application of 2 kg/ha.

80-2195. Ohmori, S.; Hirata, M. (Osaka Pref. Lab. Public Health, Osaka, Japan) **[Concentration of bromine in the specimens taken from persons who engage in fumigating methyl bromide.]** *Proc. Annu. Meet. Jpn. Soc. Ind. Hyg.* 53: 311-312; 1980 (Japanese).

Serum bromine levels were measured in persons exposed to methyl bromide during fumigation. A non-destructive radiochemical method for determination of bromine in whole blood, serum and plasma was used. Capsulated specimens were irradiated with thermo-neutron at 2×10^{13} n/cm^2/sec^2 for 1 min, followed by transfer of the irradiated specimen to a new polyethylene bag and cooling for 2-5 min. Bromine levels were determined by a wave-height analyzer Model 4096 provided with Ge-detector for 200 sec and utilization of photo-electric peak of ^{80}Br by comparison to a simultaneously irradiated specimen. Bromine concentrations in serum were high in chronically intoxication persons (350-400 ppm) and in persons engaged

in handling methyl bromide (50-90 ppm), as compared to normal persons (30-50 ppm, dry wt). Bromine levels in serum of chronically intoxicated persons was 10 × higher than that of normal persons, even after 13 days. The biological half life of methyl bromide was found to be 16 days. Bromine content of hair specimens were also determined. It was found that the concentration of bromine in hair showed the same tendency as the concentration of bromine in serum.

80-2196. Ramanujam, T.; Bellinck, C.; Mayaudon, J. (Cent. Staff Coll. Agric., Rajendranagar, Hyderabad 30, India) **Effet des herbicides sur la decomposition de la cellulose ^{14}C et de la paille ^{14}C dans les sols. Influence des phenylcarbamates sur l'activite biologique. [Effect of herbicides on decomposition of ^{14}C cellulose and ^{14}C straw in soil. Effect of phenylcarbamates on biological activity.]** *Rev. Ecol. Biol. Sol* 16(2): 151-159; 1979 (14 references) (French).

The activities of several herbicides on the decomposition of straw and cellulose in various soil types were investigated. 2,4-D, 2,4,5-T and simazine at 100 ppm significantly increased straw decomposition in sandy soils. However, these 3 herbicides as well as aniline and paraquat did not affect cellulose decomposition in soils. SN-38210, IPC (propham) and CIPC (chlorpropham) at 500 ppm strongly inhibited cellulose decomposition in soils. SN-38210 also strongly inhibited soil biological activity. SN-38584 (phenmedipham) did not affect straw decomposition or soil biological activity. When soils were amended with lignin the inhibitory effects of SN-38210 were lessened. Straw or cellulose amendments did not enhance SN-38210-inhibited soil biological activities. Soil extracts and humic acids at 5000 ppm reduced the toxicity of SN-38210.

80-2197. Bellinck, C.; Batistic, L.; Mayaudon, J. (Lab. Ecol. Microbienne, Univ. Louvain, B-1348 Louvain la Neuve, Belgium) **Degradation de l'acide 2,4-dichlorophenoxyacetique dans les sols. [Degradation of 2,4-dichlorophenoxy acetic acid in soil.]** *Rev. Ecol. Biol. Sol* 16(2): 161-168; 1979 (12 references) (French).

The breakdown of 10, 50 and 500 ppm concentrations of 2,4-D (carboxyl ^{14}C) added to two different types of soil by bacteria believed to belong to *Arthrobacter* and *Pseudomonas* genera; and the effect of chemical fertilizers on decomposition velocity, were studied. The quantity of released $^{14}CO_2$ was measured, and residual ^{14}C levels in soil extracts were determined by autoradiography. Residual radioactivity in soil treated with 10 ppm 2,4-D was reduced to 8% after 56 days incubation; 50 and 500 ppm concentrations yielded 30 and 90% levels of the respective original activities. This demonstrates that high herbicide concentrations inhibit biological decomposition. Phosphorus and potassium fertilizers were found to inhibit mineralization while calcium, magnesium and nitrogen fertilizers accelerated breakdown. The biologically stable ^{14}C in aqueous extracts from undecomposed 2,4-D, the bacteria are able to accomplish decarboxylation of the herbicide but unable to break the aromatic ring.

80-2198. Falandysz, J.; Klamecka, E. (Prov. Stn. Sanit. Epidemiol., Gdansk, Poland) **Pozostalosci chlorowanych weglowodorow aromatycznych w szprocie baltyckim (*Sprattus sprattus* L.) I jego przetworach. [Residues of aromatic chlorinated hydrocarbons in Baltic sprat (*Sprattus sprattus* L.) and in canned sprat in oil product.]** *Rocz. Panstw. Zakl. Hig.* 31(1): 61-65; 1980 (11 references) (Polish).

Determination was made of the levels of hexachlorobenzene (HCB), ΣDDT and PCBs in sprat caught in 1978 and in a canned fish product (sprat in oil) produced in 1978. In the homogenates of whole fish body, residues were 0.018, 0.62 and 0.39 mg/kg, respectively. In the lipid mass these residue levels were 0.13, 4.3 and 2.9 mg/kg, respectively. In the canned fish product the levels were 0.017, 0.46 and 0.38 mg/kg, respectively.

80-2199. Rhodes, R. C.; Krause, R. L.; Williams, M. H. (Exp. Stn., Biochem. Dep., Res. Div., E.I. du Pont de Nemours Co. Inc., Wilmington, DE 19898) **Microbial activity in soils treated with hexazinone.** *Soil Sci.* 129(5): 311-314; 1980 (4 references).

Hexazinone was added at the rate of 10 ppm to agricultural soils. The soils used in this study were Myakka sand, Fallsington sandy loam, Keyport silt loam, and Flanagan silt loam. The soil population counts of fungi and bacteria were not reduced by the addition of hexazinone. In general the microorganism populations were similar in treated and untreated soils. The Flanagan silt loam possessed the highest populations of both fungi and bacteria; the Keyport silt loam, the lowest. Hexazinone at 5 and 20 ppm had no effect on the soil nitrification processes for Fallsington sandy loam or Flanagan silt loam. Hexazinone exhibited relatively low fungitoxicity compared with two commercial fungicides, chloroneb and thiram.

80-2200. Weseloh, D. V.; Mineau, P.; Hallett, D. J. (Dep. Fish. & Environ., Canadian Wildl. Serv., Burlington, Ontario, Canada) **Organochlorine contaminants and trends in reproduction in Great Lakes herring gulls, 1974-1978.** *Trans. N. Am. Wildl. Nat. Resour. Conf.* 44: 543-557; 1979 (37 references).

Herring gulls (*Larus argentatus*) of the Great Lakes Basin were studied as indicators of environmental pollution over a period of 4 yr. Chick survival and reproductive success were studied, and eggs were analyzed for residues of organochlorine pesticides. PCB residues ranged from 42-180 ppm. DDE residues ranged from 3-24 ppm and mirex from 0.02-714 ppm. Residues of dieldrin,

hexachlorobenzene and DDT were 0.05-1.2 ppm. Increases in residue levels over the 4 yr period were greatest for DDE and DDT. No increase was observed in the level of mirex residues. Declines in the effects of pesticides on gull colonies were tabulated geographically. Lake Ontario and Lake Erie showed improvements in breeding success from 1974-1978 while Lake Huron and Lake Superior remained stable over this period. It was suggested that continued monitoring of organochlorine residue levels and reproductive success of herring gulls will serve as an indicator of pesticide contamination in Great Lakes ecosystems.

80-2201. Calvet, R.; Jamet, P. (Inst. Natl. Rech. Agron., Paris, France) **Donnees generales sur le transport des pesticides dans les sols. [General data on the transport of pesticides in soils.]** *Trav. Soc. Pharm. Montpellier* 39(4): 275-288; 1979 (13 references) (French).

Pesticide transport in the soil takes place in vapor phase, in solution or by mechanical movement of soil particles. The magnitude and manner of transport depends on physical and physico-chemical properties of the soil, which affect primarily convection and molecular diffusion. The transport of pesticides influences their biological activity, decomposition and surface and ground water pollution. In some cases intentional leaching is used to eliminate soil residues which can pollute crops. The danger of ground water pollution by pesticides is suggested to be rare, but under certain conditions is real. It is concluded that the potential of acute or chronic poisoning by contaminated ground water ingested as drinking water is small. Pesticide transport also influences the effect of persistent pesticides on the ecosystem.

80-2202. Mestres, R.; Coste, C. M.; Cooper, J. F. (Lab. Chim. Appl. Expert., Fac. Pharm. Montpellier, Montpellier, France) **Etude des residus de produits phytosanitaires dans la region de l'etang de Canet en Roussillon. [Study of pesticide residues in the Canet in Roussilon pond region.]** *Trav. Soc. Pharm. Montpellier* 39(4): 307-322; 1979 (6 references) (French).

The water and sediments of the Canet in Rousillon pond, and the water of the river and of three irrigation channels, emptying into the pond were analyzed. The pond is situated in an intensively cultivated horticultural and viticultural area where organochlorine, organophosphorus, triazine, triazole, carbamate and sulfamide herbicides are routinely used. The salt content of the pond water was 18 g/l and of river and canal water, 30 to 110 mg/l. Analysis of extracts was performed by standard methods. The PCB level found in water was 400 mg/l, normal for the region. The sediments contained 0.07 mg/kg PCBs. The lindane level in the water was 20 ng/l, normal for surface waters. DDT was detected in the water even though its use has been banned for 10 yr. Organophosphorus residues were very low.

80-2203. Rouchaud, J.; Moons, C.; Meyer, J. A. (Lab. Phytophatol., Univ. Cathol. Louvain, B-1348 Louvain-la-Neuve, Belgium) **La metabolisation de la ^{3}H-triforine dans l'orge: etude du residu lie (la radio-activite non soluble dans le methanol). [Metabolization of ^{3}H-triforine in barley: residue linkage (radioactivity insoluble in methanol).]** *Trav. Soc. Pharm. Montpellier* 39(4): 347-348; 1979 (French).

A barley culture was sprayed with the tridiated fungicide triforine and harvested when ripe. The grain and straw were separately extracted with methanol. The respective radioactivities were determined and traced to the various radioactive products. The solid mass resulting from grain extraction with methanol contained 75% ^{3}H of total tritium in the grain, of which 7% ^{3}H was solubilized by extraction with acidified methanol. An additional 27% ^{3}H was extracted by 0.03 *M* NaOH from glycine, serine and a mix of a great number of amino acids. The cellulose and starch fractions were also analyzed. Analogous determinations were made for the straw.

80-2204. Piffaut, B.; Metche, M. (Lab. Biochim. Appl., E.N.S.A.I.A., Nancy, France) **Metabolisation du quinomethionate (6-methyl-quinoxaline 2,3-dithiolcyclocarbonate) par une algue verte du genre *Ankistrodesmus falcatus*. [Metabolization of quinomethionate (6-methyl-quinoxaline- 2,3-dithiocyclocarbonate) by a green alga of the Ankistrodesmus falfatus genus.]** *Trav. Soc. Pharm. Montpellier* 39(4): 349-350; 1979 (3 references) (French).

The degradation of quinomethionate (Q) (6-methyl-quinoxaline- 2,3-dithiocyclocarbonate), used as a fungicide on cucumbers, by a green alga, *Ankistrodesmus falcatus* isolated from seeds of a cucumber culture, was studied. Q inhibited the photosynthetic activity of the algae. The algae actively decomposed Q to CO_2. One of two intermediary metabolites of Q resulting from biohalogenation was identified as 6-meta-2-amino-3-chloroquinoxaline, which is highly toxic to plants. The biohalogenation process is suggested to be induced by a chloroperoxidase. The process has so far been observed only in *Rhodophyceae* marine algae. In this case the algae transforms Q, a substance of low toxicity, into a cucumber herbicide. Certain *Rhodophyceae* excrete substances toxic to aquatic fauna, and it is suggested that soil algae found frequently in rivers may be also toxic to environmental flora and fauna.

80-2205. Terce, M.; Calvet, R. (I.N.R.A., Versailles, France) **Effet de l'acidite sur l'adsorption de la terbutryne par la montmorillonite. [The effect of acidity on the adsorption of terbutryn by a montmorillonite.]** *Trav. Soc. Pharm. Montpellier* 39(4): 353-354; 1979 (French).

The adsorption of terbutryn by a montmorillonite at various pH values was studied. When sodium or calcium were the compensating cations, adsorption of terbutryn in-

creased under conditions of medium acidity. The principal adsorption mechanism in such instances was ion exchange between mineral cation and protonated terbutryn. In Al clay, adsorption of terbutryn decreased with decreasing acidity. It is suggested that this decrease was due to a greater affinity of the surface for neutral molecules than for protonated terbutryn. In diluted clay suspensions adsorption was greater than in concentrated suspensions. This was due to partial hydrolysis of clay lattices in acid media leading to the formation of hydroxide materials.

80-2206. Calvet, R.; Lefebvre-Drouet, E. (Stn. Sci. Sol, I.N.R.A., F-78000 Versailles, France) **Observations sur la relation entre l'adsorption de l'atrazine par des sols et l'effect phytotoxique sur des algues vertes. [Observations of the relation between adsorption of atrazine by soil and the phytotoxic effect on green algae.]** *Trav. Soc. Pharm. Montpellier* 39(4): 355-356; 1979 (2 references) (French).

Several types of soil were used to study the adsorption isotherms of atrazine and determine its distribution coefficients. Biological tests with green algae *(chlorella)* were used to determine the phytotoxicity of atrazine. The results suggest that there is no relation between the distribution coefficient and the quantity of atrazine needed to allow a 50% inhibition of the production of pigments. No relation was noted between the theoretical biological effect calculated from adsorption isotherms and the observed biological effect.

80-2207. Arvieu, J. C. (Stn. Agron. & Physiol. Veg., Antibes, France) **Les phenomenes d'immobilisation du bromure de methyle (BM) dans le sol: dissolution aqueuse et adsorption. [Immobilization phenomena of methyl bromide in the soil: aqueous dissolution and adsorption.]** *Trav. Soc. Pharm. Montpellier* 39(4): 357-358; 1979 (French).

Aqueous dissolution and adsorption on solid phases was found to slow the rapid penetration of the soil by methyl bromide. For the methyl bromide to penetrate, 60-80% of the applied pesticide must be in aqueous solution. The attainment of solubility equilibrium is influenced by temperature, water and pesticide amounts, and available volume for gases in the soil. Evaporation of the dissolved product is slow. The adsorption of the pesticide depends on the percentage of organic matter present in the soil. Soils low in organic matter show little adsorption; soils rich in organic matter show higher adsorption levels. It is concluded that the behavior of the pesticide in the soil is influenced by aqueous dissolution and adsorption in ways which may affect its persistence and bioactivity.

80-2208. Bastide, J.; Coste, C.; Khafif, T. (G.E.R.A.P., Univ. Peripignan, F-66025 Peripignan Cedex, France) **Influence des facteurs lies au sol sur l'hydrolyse du chlorbufame. [The effect of soil factors on chlorobufam hydrolysis.]** *Trav. Soc. Pharm. Montpellier* 39(4): 359-360; 1979 (French).

The effect of soil characteristics on decomposition of chlorofubam (1-methyl *N*-(2-chlorophenyl) 2-propynyl carbamilate) was studied in sterile and non-sterile soils. Adsorption of chlorobufam by humic acids alone was 50% in 3 hr, which influenced hydrolysis of the compound. Hydrolysis slowed in the presence of humic acids at a constant pH and temperature in a manner similar to that which occurs in the presence of a sodium phosphate buffer. Chlorobufam was concluded to be stablized by adsorption to humic acids. The addition of humic acids to a medium (vermiculite) containing chlorobufam also reduced its phytotoxicity to barley, but at the same time prolonged the phytotoxic effect. Organic matter was found to accelerate hydrolysis of chlorobufam in sterile soils. Isolated humic acids were found to slow hydrolysis.

80-2209. Buzio, C. A.; Burt, G. W. (Agron. Dep., Univ. Maryland, College Park, MD 20742) **Leaching of EPTC and R-25788 in soil.** *Weed Sci.* 28(3): 241-245; 1980 (10 references).

Leaching of EPTC (*S*-ethyl dipropylthiocarbamate) plus R-27688 (*N*,*N*-diallyl-2,2-dichloroacetamide) through columns of 4 soils resulted in the separation of R-25788. Separation of R-25788 from EPTC was greater in coarser than in finer textured soils. When soil columns were placed under drying conditions for 6 days after leaching, R-25788 moved upward in the columns faster than EPTC. (Author abstract by permission)

80-2210. Johnsen, T. N., Jr.; Warskow, W. L. (Agric. Res., SEA, USDA, Tucson, AZ 85719) **Effects of fall burning of chaparral woodland on soil residues of picloram.** *Weed Sci.* 28(3): 282-284; 1980 (13 references).

Residue of picloram (4-amino-3,5,6-trichloropicolinic acid) aerially sprayed onto a central Arizona chaparral stand was markedly reduced in the surface 7.6 cm of soil from a fall burn conducted 5 wk later. Picloram was applied at a rate of 2.2 kg/ha 5 mo before the fire. In the 0-2.5 cm soil layer 0.96 kg/ha of picloram was present before the burn and, after the burn, 0.06 kg/ha were observed. In the 2.6-7.5 cm layer these findings were 1.41 and 0.08 kg/ha, respectively, and in the 7.6-15.2 layer, 0.03 and 0.01 kg/ha, respectively. Brush control was also reduced. (Author abstract by permission, supplemented)

80-2211. Barudi, W.; Bielig, H. J. (Inst. Lebensmitteltechnol. Frucht & Gemusetechnol., Techn. Univ., D-1000 Berlin 33, BRD) **Gehalt an Schwermetallen (Arsen, Blei, Cadmium, Quecksilber) in oberirdisch Wachsenden Gemuese- und Obstarten. [Heavy metal content (As, Pb, Cd, Hg) of vegetables which grow above ground and**

fruits.] *Z. Lebensm. Unters. Forsch.* 170(4): 254-257; 1980 (5 references) (German).

Sixteen varieties of vegetables were gathered and 157 samples were taken. Six varieties of fruit were also collected and 83 samples were taken from these. Arsenic, lead and mercury contamination of these samples was investigated using atomic absorption spectroscopy. Leafy vegetables were more heavily contaminated than other vegetable varieties. Each of the fruit samples had less heavy metal contamination than did the vegetables. It was determined from this study that the average weekly exposure of the population of the BRD is below the maximum tolerance level.

80-2212. Mueller, R.; Lingens, F. (Inst. Mikrobiol., Univ. Hohenheim, D-7000 Stuttgart 70, BRD) **Enzymatische Bildung und Isolierung von 2-Hydroxymuconsaeure, ein Metabolit im bakteriellen Abbau des Herbizids Chloridazon. [Enzymatic formation and isolation of 2-hydroxymuconic acid, a metabolite in the bacterial degradation of the herbicide chloridazon.]** *Z. Naturforsch.* 35(3-4): 346-347; 1980 (7 references) (German).

The microbial decomposition of the herbicide chloridazon (5-amino-4-chloro-2-phenyl-2H-pyridazine-3-on) was studied by TLC and spectroscopy. 2-Hydroxymuconic acid was isolated, following incubation of chloridazon with purified metapyrocatechase and enriched amidase, as a product of chloridazon decomposing bacteria, by reversed phase high-performance liquid chromatography. Retention times and R_f-values in TLC and spectroscopic findings were used to identify the decomposition products.

See also 80-2101, 80-2117, 80-2118, 80-2120, 80-2121, 80-2125, 80-2127, 80-2133, 80-2137, 80-2141, 80-2144, 80-2146, 80-2147, 80-2148, 80-2214, 80-2221, 80-2226, 80-2230, 80-2233, 80-2264, 80-2269, 80-2305, 80-2306, 80-2366, 80-2369, 80-2376, 80-2383 *and* 80-2398.

80-2213. Takahashi, W.; Dickinson, L. E. (Pacific Biomed. Res. Cent., Univ. Hawaii, Honolulu, HI) **Liver cancer mortality and DDT exposure.** *Abstr. Natl. Meet. Am. Assoc. Adv. Sci.* 146: 121; 1980.

The possible association between DDT exposure and carcinogenicity was investigated. Spearman's rank-order correlation analysis was used to compare DDT usage and changes in mortality rates due to cancer of the liver and biliary passages for the 48 contiguous states. No significant correlation was found between DDT exposure and liver cancer mortality. It is suggested that this does not exclude the possibility of an association between the induction of hepatic lesions in the mouse and the carcinogenicity of DDT in man. [Presented at the 146th National Meeting of the American Association for the Advancement of Science]

80-2214. Longo, L. D. (Div. Perinat. Biol., Dep. Obstet. & Gyn., Sch. Med., Loma Linda Univ., Loma Linda, CA) **Environmental pollution and pregnancy: risks and uncertainties for the fetus and infant.** *Am. J. Obstet. Gynecol.* 127(2): 162-173; 1980 (100 references).

The importance of macroenvironmental pollutants (heavy metals, dioxins, PCBs, and pesticides) in the mutagenesis and teratogenesis of developing embryos, fetuses, and infants is explored. The ethical and legal implications of these toxins as well as of microenvironmental pollutants are reviewed. Of the 1500 active ingredients of registered pesticides, approximately one third are toxic and one quarter are mutagenic and carcinogenic. Once in the food chain, these pesticides are almost impossible to eliminate. They can cause sterility and birth defects. One of the most widely used chlorinated insecticides, toxaphene, is highly mutagenic. Some, such as chlorinated hydrocarbons, are readily transmitted to infants via breast milk. A need for more research in the area of the effects of these chemicals on the developing organism is cited.

80-2215. Houten, L.; Sonnesso, G. (Dep. Res. Med., Univ. Pennsylvania, Philadelphia, PA 19104) **Occupational exposure and cancer of the liver.** *Arch. Environ. Health* 35(1): 51-53; 1980 (4 references).

The relation between occupational exposure and cancer of the liver was investigated. Cases of liver cancer in 102 patients from 1956-65 were studied. Five male cases were associated with general crop and livestock farms, and one with a poultry farm. Of the 56 male liver cancer cases studied 4 were farmers in general crop and livestock farms, 1 was a laborer in chemical industry and 1 was a laborer in food industry. Excess risk was determined for men working in the non-electrical machinery and primary metal industries. Other factors possibly related to these associations were studied, but no conclusions were made. (Author abstract by permission, modified)

80-2216. Engler, R.; Rogoff, M. H. (Hazard Eval. Div., Off. Pestic. Programs, US EPA, Washington, DC 20460) **Registration and regulation of microbial pesticides.** *Biotechnol. Bioeng.* 22(7): 1441-1448; 1980 (7 references).

The growth in use of microbial pesticides during the past few years is reviewed and reasons are noted for the slow development at the industrial level. Basically a case-by-case consideration in evaluating the hazard of the microbial pesticides submitted for registration was followed by the EPA, but this approach was usually in terms of entire subgroups as opposed to individual agents. EPA policy on biorational pesticides mandates development of testing guidelines for biologicals within 24 mo. An interim guideline for testing regimens, hazard evaluation and risk assessment has been drafted and is currently under review. This interim guide follows a tier-approach to hazard evaluation for humans, fish, and wildlife, and the evaluation of environmental impact. A series of maximum hazard tests (MHT) is the first tier. The approach is predicated on the general assumption that the pesticidal microorganisms will not be pathogenic to non-target species. MHTs are designed to demonstrate under controlled laboratory conditions that this assumption is true and supportable by experimentation.

80-2217. Knaak, J. B.; Schlocker, P.; Ackerman, C. R.; Seiber, J. N. (California Dep. Food & Agric., Sacramento, CA 95814) **Reentry research: establishment of safe pesticide levels on foliage.** *Bull. Environ. Contam. Toxicol.* 24(5): 796-804; 1980 (16 references).

A procedure for determining safe levels of pesticides on tree foliage is described which uses a dermal dose-red cell cholinesterase (ChE) response curve and previously collected field reentry data. Male Sprague Dawley rats were topically treated with varying doses of paraoxon, parathion, dialifor, phosalone, azinphosmethyl, methidathion, or dimethoate. Paraoxon was the most toxic organophosphate tested while dimethoate was the least. In general the exposure to the pesticides resulted in larger slopes for red blood cell ChE and smaller slopes for plasma ChE. Methidathion and dialifor gave the largest response slope and parathion gave the smallest slope. ED50 values are obtained from the ChE-dose response curve. The ED50 values (in $\mu g/cm^2$ body surface) are divided by the ED50 of the standard pesticide to obtain the relative toxicity of the test pesticide. The relative toxicity is then multipled by the safe level of standard (previously determined from field reentry data) to obtain the safe level of the test pesticide on foliage in $\mu g/cm^2$.

80-2218. Wicker, G. W. (North Carolina State Univ., Raleigh, NC) **Exposure of field workers to organophosphorus insecticides.** *Diss. Abstr. Int. B* 40(11): 5136; 1980.

The potential hazard to field workers involved in handling insecticide treated crops in the course of their normal work activities was evaluated. An epidemiological survey was conducted to estimate the distribution and

usage patterns of insecticides in North Carolina and to identify potential health hazards. Certain crops receiving repeated applications of high toxicity organophosphorus insecticides during the time requiring extensive hand labor were selected for further study. Absorption of these insecticides was measured indirectly by biochemical parameters, plasma and red blood cell cholinesterase (ChE) and, in some cases, urinary metabolites. Workers packing sweet corn, treated with a combination of methyl and ethyl parathion 1 or 2 days before being harvested mechanically, exhibited significant depression of ChE. Gloves, worn by 40% of the workers, provided some protection from absorption of pesticide residues. No significant ChE depression was found in workers thinning peaches that had been previously treated with parathion. It is concluded that there does not appear to be a serious reentry problem in North Carolina except in those unusual cases where gross indifference to federal reentry standards occur. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 8005567)

80-2219. Simonffy, Z.; Poroszlay-Vida, B.; Jancso-Horvath, E.; Frigyer-Tili, I. (Res. Lab., Agric. Minist., H-1091 Budapest, Hungary) **Egeszegre artalmas vegyi anyag (peszticid) maradekok mennyisegenek alakulasa allati eredetu elelmiszerekben. [The quantity of toxic remnants (pesticides) in food products of animal origin.]** *Elelmez. Ipar* 33(8): 310-313; 1979 (Hungarian).

Regulations in force for the determination of biologically active toxic remnants in products of animal origin are presented. Also discussed are the methods used in these determinations. The products which were studied in this report satisfy the Hungarian and the international requirements regarding residues of biologically active chemicals.

80-2220. Chapman, H. C.; Davidson, E. W.; Laird, M.; Roberts, D. W.; Undeen, A. H. (USDA, Lake Charles, LA 70601) **Safety of microbial control agents to non-target invertebrates.** *Environ. Conserv.* 6(4): 278-281; 1979.

Information from the Society for Invertebrate Pathology's Working Group on the Safety of Microbial Control Agents is summarized. It was concluded that informed selection of non-target invertebrates for safety-testing is a major priority. This testing would be concentrated on major invertebrate predators of vectors. Data from field and laboratory tests of exposure to field dosages of the microbial control agents, and to the ingestion of infected larval vectors by the selected predators would answer environmental impact questions and also provide information for designing effective integrated control methodologies with biocontrol components.

80-2221. Rogan, W. J.; Gladen, B. (NIEHS, Research Triangle Park, NC 27709) **The breast milk and formula project: current status.** *Environ. Health Perspect.* 33: 344; 1979.

Beginning in 1978 specimens of breast milk, formula, colostrum, placenta, cord blood and maternal blood have been collected from newborn infants and their mothers in North Carolina. Breast milk or formula is subsequently collected at 6 wk, 3 and 6 mo, and 1 yr. Maternal blood samples are drawn at the 6 wk visit. The specimens are analyzed for polychlorinated biphenyls, DDT and DDE, total organic chlorine and total organic bromine to determine a correlation between exposure to environmental chemicals through breast milk and child health. It is stated that no reports have been made in the United States which link illness in babies to exposure to environmental chemicals through breast milk. [Presented at the NIEHS Second Biennial Sci. Seminar]

80-2222. Miller, S. (Author address not given) **Environmental health hazards.** *Environ. Sci. Technol.* 14(6): 648-651; 1980.

Progress in evaluating and studying environmental health hazards by the Board of Toxicology and Environmental Health Hazards of the Assembly of Life Sciences of the National Academy of Sciences is reviewed. The first NAS report *Drinking Water and Health* is also reviewed. This report deals with disinfection of drinking water, chemistry of disinfectants, evaluating activated carbon for water treatment, epidemiological studies of cancer frequency and organic constituents of drinking water, problems connected with risk assessment, toxicity of water contaminants, and contributions drinking water to mineral nutrition of humans. NAS interest in area-wide chemical contamination caused by such chemicals as TCDD, PCBs, Kepone (chlordecone), DBCP (dibromochloropropane), lead, methyl mercury, chlorinated hydrocarbons, and PBBs. Brief descriptions of tragedies which have occurred due to contamination by these chemicals are also included.

80-2223. Fokina, K. B. (Inst. Hyg. & Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **Reoentsefalograficheskaya diagnostika sosudistoi patologii golovogo mozga u lits, kontaktiruyashchikh s kompleksom pestitsidov. [Rheoencephalographic diagnosis of vascular pathology of brain in persons exposed to a complex of pesticides.]** *Gig. Tr. Prof. Zabol.* (4): 49-50; 1980 (Russian).

To identify symptoms of cerebral pathology in pesticide poisoning a group of 87 agricultural workers who had a prolonged exposure to a complex of organochlorine, organophosphorus, and organomercuric pesticides were subjected to rheoencephalographic examination. Clinical examination showed that 32.2% of the workers had vegetovascular dystonia and stenovegetative syndrome (compared with 13.5% in the control group), 12.6% had hypothalamic syndrome (*vs.* 2.7% in the control), 12.6% had hypertonic disease of II degree (*vs.* 2.7% in the control), and 42.5% had cerebral atherosclerosis (*vs.* 21.6% in the control).

Rheoencephalography showed more pronounced changes of the cerebral hemodynamics in workers who had prolonged exposure to pesticides; the degree of changes of the rheonencephalogram was correlated with the degree of clinical manifestations of vascular pathology of the brain.

80-2224. Siddiqui, M. K. J.; Seth, T. D.; Bhargava, A. K.; Saxena, M. C. (Ind. Toxicol. Res. Cent., Lucknow 226001, India) **Acetylcholinesterase activity in the red blood cells of pregnant women and their foetus *(sic).*** *Indian J. Exp. Biol.* 18(1): 51; 1980 (15 references).

Blood was collected from 30 women who had no history of exposure to pesticides and who were in their third trimester of pregnancy. Cord blood was collected during labor and blood was also collected from the same women after delivery. The mean levels of red blood cell acetylcholinesterase (RBC AChE) and plasma cholinesterase (ChE) in pregnant women were 8.27 and 1.75, respectively. The mean levels of enzyme activity in red blood cells of mothers after delivery decreased with increased age. Babies, born to mothers 20-30-yr-old, were noted to have RBC AChE levels of about 55% of the maternal levels. In babies of mothers 30-35-yr-old this rose to 80%.

80-2225. Gunby, P. (Author address not given) **Agent Orange: what's to be done by whom?** *J. Am. Med. Assoc.* 243(23): 2375, 2379; 1980 (2 references).

Possible effects on the health of service personnel involved in the spraying of Agent Orange defoliant (2,4-D, 2,4,5-T and TCDD) in Southeast Asia are being examined by various governmental agencies. The Air Force is conducting a study of the question of health effects. However, the National Research Council suggests that there are major weaknesses in the design of the Air Force study. Recommendations are being sent to the newly established Interagency Work Group to Study Possible Long-term Health Effects of Phenoxy Herbicides and Contaminants in order to obtain a determination of how this study should be conducted, and by whom. During the defoliation procedure about 42.6 million *l* of Agent Orange alone were sprayed on 1.4 million ha. EPA last year imposed an emergency ban on many uses of 2,4,5-T and silvex. Toxicity studies have now been ordered on 2,4-D because of its close structural relationship to 2,4,5-T and silvex.

80-2226. Gupta, S. K.; Pandya, M. K.; Jani, J. P.; Kashyap, S. K. (Natl. Inst. Occupat. Health, Gujarat, India) **Health risks in ultra-low-volume (ULV) aerial spray of malathion for mosquito control.** *J. Environ. Sci. Health B* 15(3): 287-294; 1980 (6 references).

A sewage farm was sprayed aerially with technical malathion at the rate of 300 ml/ha to control mosquitos. The helicopter flew at a speed of 50-60 km/hr and at a height of about 20 ft. A total of 19 persons either handled the pesticide for loading and unloading the aircraft, worked in the field where the insecticide was sprayed, or were part of the aircraft maintenance staff. None of the subjects used protective devices such as overalls, gloves, or face masks. Medical examinations of the individuals revealed only generalized vague toxicity symptoms, including weakness, nausea and mild irritation of the eyes. Plasma cholinesterase activity was significantly depressed in laborers who handled the insecticide compared to laborers in the fields. No depression of this enzyme activity was noted in aircraft personnel. The residual concentration of malathion after 2 hr of the spray was 315 ppm in grass which sharply declined to 40 ppm within the following 48 hr.

80-2227. Hayashi, T. (Water Resources Dev. Public Corp., Tokyo, Japan) **Water pollution control in Japan.** *J. Water Pollut. Control Fed.* 52(5): 850-861; 1980 (2 references).

This review discussed the history of legislation and administrative practices related to the control of water pollution in Japan. Various laws which are considered include the Water Quality Conservation Law, the Factory Effluents Control Law, the Basic Law for Environmental Pollution Control, the Water Pollution Control Law, and the Seto Inland Sea Conservation Law. The duties of various ministries and agencies closely concerned with water pollution are outlined. The current state of pollution countermeasures is reviewed with emphasis on water quality standards, current effluents control systems, and national uniform effluent standards.

80-2228. Burek, J. D.; Schwetz, B. A. (Toxicol. Res. Lab., Health & Environ. Sci., Dow Chem. Co., Midland, MI 48640) **Considerations in the selection and use of chemicals within the animal facility.** *Lab. Anim. Sci.* 30(2Pt2): 414-421; 1980 (31 references).

A review of the chemicals routinely used in animal-rearing facilities is presented. Factors that should be considered in the selection of these chemicals are discussed. Soaps, detergents, disinfectants and pesticides are the primary chemicals utilized. Enzyme inhibition and increased or decreased toxicity of other compounds may result from the exposure of lab animals to pesticides. DDT, PCBs and urea herbicides may stimulate microsomal enzymes, while organophosphates tend to inhibit them. It is suggested that the results of laboratory tests could be altered due to exposure to a variety of chemicals in the animal facility. Several regulatory considerations are discussed.

80-2229. Stasiewicz, J. H. (Bristol Park Med. Group Inc., Costa Mesa, CA) **Pregnancy in the workplace.** *Occup. Health Nurs.* 28(5): 13-17; 1980 (14 references).

Problems involving pregnant women working at jobs which may expose them to toxic substances are reviewed. Toxicity tests on laboratory animals are discussed. The problem of extrapolating data from mice and other lab species to humans is considered. Often the amount of the toxic agent to which the laboratory animal is exposed is much greater than that occurring in the workplace, and the applicability of these results have been questioned. The effects of various chemicals on newborn laboratory species have been studied, but it is suggested that much more work is needed in the areas of long-term and subtle consequences. It is suggested that pregnant women should not be exposed to such subsances as DDT, chlordane, Kepone (chlordecone) and carbaryl. These substances have shown marked toxicity to kidneys, liver and nervous systems, and there is recent evidence linking them to cancer, mutations and decreased fertility. It is also suggested that imported foods such as bananas, pineapples, tomatoes, melons, grapes and strawberries should be avoided by pregnant women because the foods may be contaminated with pesticides which are no longer legal for use in the United States, but which are still used elsewhere.

80-2230. Matsumura, F.; Madhukar, B. V. (Pestic. Res. Cent., Michigan State Univ., East Lansing, MI 48824) **Exposure to insecticides.** *Pharmacol. Ther. Part A* 9(1): 27-49; 1980 (127 references).

Direct and indirect means of exposure to insecticides are reviewed. Exposure is discussed in terms of increasing safety against pesticides. The relation of toxicity of pesticides and route of administration is considered. General patterns relating to direct exposure are discussed for cases of oral exposure among occupational workers and the general public, respiratory exposure, dermal exposure and exposure through the eye. Means by which indirect exposure to pesticides may occur are also considered, including residues present in water, air, soil and food. Other means of exposure to pesticides which are included in the review are exposure through cigarette smoking, through residues in house dust from domestic use of pesticides, through the mother to the unborn child, and through breast milk to the infant. Death and the possible increased risk of cancer as a result of pesticide exposure are also considered.

80-2231. Shirakawa, M.; Fukushima, R.; Hisazima, K.; Miyata, Y. (Sch. Hyg., Miyazaki Med. Coll., Miyazaki, Japan) **[Results of mass survey on inhabitants in Kiyotake in Miyazaki prefecture. IX. Present status of Farmers disease and intoxication due to pesticides for agricultural use.]** *Proc. Annu. Meet. Jpn. Soc. Ind. Hyg.* 53: 97-98; 1980 (Japanese).

A major medical survey was conducted in July 1979 on 289 men and 522 women between the ages of 20 and 60; 7.3% were 20-29; 25.2%, 30-39; 27.0%, 40-49; 28.5%, 50-59; and 12.0%, 60-69. Of these, 469 were engaged in farming or other agricultural practices. The frequencies of pesticide use as a percent of total use were: fenthion, 10.1%; zineb, 14.5%; methomyl, 7.2%; BHC, 5.6%; captafol, 5.5%; and all others 57.1%. In male patients, 36 (19.8%) were intoxicated by pesticides; 35.3% by captafol, 23.5% by parathion and 41.2% by all others. Among females, 28 (13.6%) were intoxicated by pesticides; 50% by captafol and 50% by all others. The pesticides most frequently involved in intoxications among all those surveyed were captafol and parathion.

80-2232. Stanton, G. B. (Am. Hazard Control Consultants Inc., Essex Falls, NJ) **Controlling toxic substances and hazardous materials.** *Prof. Saf.* 25(6): 21-27; 1980.

The importance of various chemicals in our everyday life and in our national economy is reviewed. However, the need for these chemicals to be controlled is also considered. The parts played by the Toxic Substances Control Act and the Resources Conservation and Recovery Act in the life cycle of chemical products are discussed. Examples of events which lead to the passage of such key legislation in this field of environmental concern are described. The legislation itself is explained and current important issues, sources of information and suggestions for safety are listed. A list of ten steps is provided which should aid in controlling hazardous materials and toxic substances.

80-2233. Dhiensiri, K.; Sinavatana, P.; Lertsookprasert, S. (Khon Kaen Hosp., Khon Kaen, Thailand) **Reye's syndrome in northeastern Thailand.** In: *Reye's Syndrome II.* Crocker, J. F. S., ed. (Grune & Stratton: NY): pp. 77-98; 1979 (20 references).

Two surveys of Reye's syndrome cases which occurred 8 yr apart are compared to demonstrate the association of the regularity and pattern of the disease with rainfall, agricultural patterns and pesticide use in northeastern Thailand. Generally, a higher incidence and mortality rate occurred in young female children. The most consistent symptoms were hypoglycemia, and abrupt, early morning convulsions and coma. The disease occurred most frequently in the rural areas and was closely correlated to the agricultural practices of the villages. High rainfall meant good growing conditions and exposures to pesticides (parathion, endrin, 2,4-D and carbaryl) were greatest in the months of July to October (the post-rice planting stage). Prolonged exposures to pesticides were noted in 100% of the Reye's syndrome cases. A correlation between pesticide import and the occurrence of Reye's syndrome in Thailand is suggested. The findings tend to support the hypothesis of an occurrence of virus-toxin interaction in the etiology of Reye's syndrome. However, some aspects of the syndrome may be influenced by genetic, nutritional or unidentified environmental factors.

80-2234. Dedek, W. (Author address not given) **Zur toxikologischen Bewertung von Pestizid-Wirkstoffen. [Toxicological evaluation of pesticides.]** *Sitzungsber. Akad. Wiss. DDR* 11N: 35-36; 1978 (German).

Comments on the WHO 'Recommended Classification of Pesticides by Hazard' from the 4th Workshop of the International Association on Occupational Health, Committee on Pesticides, held in Bratislava, Czechoslovakia in 1977 are summarized. It is suggested that WHO should evaluate data obtained by long-term studies on exposure in laboratories, industrial plants and open air. The quantitative analysis of all technical pesticides is recommended. The importance of toxicological data of pesticide preparations, obtained experimentally, not by calculation from pure or technical active agents, is discussed. The use of appropriate analytical methods to measure the total resorbed quantity of active agents is discussed. Quantitative determination of active substance and metabolites in urine is recommended for use instead of measurement of cholinesterase inhibition. Resorption rather than inhalation is recommended as the main parameter of worker exposure studied, not from animal experiments. Information dissemination is found to be inadequate.

80-2235. Weinberg, M. S.; Dalal, N. (Booz Allen & Hamilton Inc., Florham Park, NJ) **How to keep your options open: implications of FIFRA for producers of consumer products.** *Soap Cosmet. Chem. Spec.* 56(5): 31-33; 1980.

The Federal Insecticide Fungicide and Rodenticide Act (FIFRA) is reviewed. Requirements under FIFRA include the registration of all pesticides which will be involved in interstate commerce and a reregistration of all pesticides every 5 yr in order that the most recent experiences with them can be considered. However, techniques for carrying out the provisions of the statute are not currently developed. Registration itself is a costly and time consuming operation. Registration of a new active ingredient can only be justified when a company has a promise of major market potential. While reregistration is not a current problem due to the fact that the entire program is not firmly established, in time the call for reregistration may put some active ingredients registered years ago under more lenient circumstances in jeopardy. The RPAR (Rebuttable Presumption Against Registration) is also discussed. This is an EPA procedure for challenging an existing registration in light on new safety information. It is concluded that, due to the huge costs involved in registering new agents, new product development will continue to concentrate on building new formulae from the list of previously registered agents.

80-2236. Kaskevich, L. M. (Dep. Clin. Pathol. Chem. Etiol., All-Union Res. Inst. Pestic. Polym. & Plast., Kiev, USSR) **O kharaktere doklinicheskikh izmenenii pri vozdeistvii nompleksa khlor- i fosfororganicheskikh pestitsidov. [On the character of pre-clinical changes under the effect of a complex of chlor-and phosphor-organic pesticides.]** *Vrach. Delo* (4): 105-107; 1980 (Russian).

The results of comprehensive examination of 140 healthy individuals (88% women; aged 20-45 yr) who had been occupationally exposed to a complex of organochlorine and organophosphorus pesticides are reported. The most frequent preclinical changes was angiodistonic syndrome. Rheoencephalography showed 40% of the subjects to have cerebral hypertension syndrome. Prolonged occupational exposure (> 6 yr) resulted in decreased intensity of blood filling in the network of internal carotid arteries. Analysis of electrolyte balance showed decreased content of potassium in RBC (11.4-12.7% decrease, depending upon the duration of exposure) and increased concentration of sodium (8-14.8%).

80-2237. Ivanov, I.; Szucki, B.; Domanska, I. (Med. Acad., Inst. Hyg. & Occup. Dis., Sofia, Bulgaria) **Study of pesticide intoxications in Bulgaria, Poland.** *Worldwide Rep. Epediomol.* 181: 1-5; 1980 (9 references).

Problems caused by the increased use of pesticides, and the relation of this to protecting the health of chemical and agricultural workers and the general population in Bulgaria and Poland, is reviewed. The problems of residues in foodstuffs and pollution of the soil, water and air are also discussed. In Poland, 46% of the pesticide intoxications were not occupationally related. Suicide accounted for 15.6% and accidental exposure for 30.61%. Mortality rate among suicide attempts was 21.6%. In Bulgaria the highest number of poisonings resulting from occupational exposure was noted among crop growers, (51%), followed by general workers and brigade leaders who assist in agriculture (15%). The greatest number of incidents were caused by PHOS (75%). Organochlorine intoxication accounted for 5%. In Poland, the greatest number of occupational intoxications with pesticides were caused by organochlorine compounds (30.8%), followed by organophosphorus compounds and chemical fertilizers.

See also 80-2101, 80-2102, 80-2115, 80-2116, 80-2117, 80-2121, 80-2144, 80-2149, 80-2168, 80-2260, 80-2305, 80-2343, 80-2344 *and* 80-2366.

80-2238. Singh, A.; Abbott, T.; Valli, V. E. O.; Villeneuve, D. C. (Dep. Biomed. Sci., Ontario Vet. Coll., Guelph, Ontario, Canada) **The hepatotoxicity of photomirex: a one-year recovery study.** *Abstr. Natl. Meet. Am. Assoc. Adv. Sci.* 146: 138; 1980.

Male Sprague-Dawley rats were used in experiments designed to determine the hepatotoxicity of photomirex. Rats were fed diets containing 0, 0.05, 0.5, 5 or 50 ppm photomirex for 28 days, then were placed on clean feed for one year. At this time livers were examined by transmission electron microscopy. All treated groups showed altered bile canaliculi consisting of distended lumina and absent or reduced microvilli, and wide interhepatocyte spaces. In the 0.05-0.5 ppm groups, lipid droplets increased moderately in the parenchymal cells, and fat-storing cells were conspicuous. At the 5 ppm level, the smooth-surfaced endoplasmic reticulum (SER) increased moderately in the parenchymal cells, while animals fed 50 ppm photomirex showed extensive areas of hepatocytic SER. It is concluded that treatment with 0.05-50 ppm photomirex for 28 days causes alterations in rat liver for at least one year. [Presented at the 146th National Meeting of the American Association for the Advancement of Science]

80-2239. Nordgren, I.; Holmstedt, B.; Bengtsson, E.; Finkel, Y. (Dep. Toxicol., Karolinska Inst., Fack 10401, Stockholm, Sweden) **Plasma levels of metrifonate and dichlorvos during treatment of schistosomiasis with Bilarcil.** *Am. J. Trop. Med. Hyg.* 29(3): 426-430; 1980 (21 references).

Two patients were treated twice with six 100 mg Bilarcil (7.5 mg/kg metrifonate; trichlorfon) tablets at 14 day intervals for schistosomiasis control. Metrifonate and its re-arrangement product, DDVP (dichlorvos), were monitored in blood plasma for up to 5 days to determine their pharmacokinetics and their effects on plasma and erythrocyte cholinesterase (ChE). In both cases, DDVP formation was $\sim$ 1% of the metrifonate levels. After the first treatment in both patients, metrifonate levels peaked between 1 and 2 hr after dosing and were considerably lower by 8 hr after administration. One patient had higher overall levels of both metrifonate and DDVP than the other and was also noted to have more pronounced plasma ChE inhibition. In both patients, erythrocyte ChE was 50-60% of normal.

80-2240. Wagstaff, D. J.; McDowell, J. R.; Paulin, H. J. (Epidemiol. Unit, Bur. Foods, FDA, Washington, DC 20204) **Heptachlor residue accumulation and depletion in broiler chickens.** *Am. J. Vet. Res.* 41(5): 765-768; 1980 (23 references).

Broiler chickens were fed heptachlor at concentrations of 0, 0.01, 0.03, 0.1 and 0.3 mg/kg of feed for the first 8 wk of life. Three birds from each group were sacrificed at 1, 2, 4, 8, 10, 12 and 14 wk. Samples of muscle, liver and abdominal adipose tissue were collected and analyzed for heptachlor and heptachlor epoxide (HE) by gas-liquid chromatography. There were no clinical effects or deaths due to any of the heptachlor concentrations tested, but residues of heptachlor and HE were found in all samples. The highest concentrations were found in adipose tissue, where residue concentrations were related to the heptachlor concentration in the feed and plateaued at concentrations about 5 × greater than those in the feed. The ratio of the concentration of heptachlor to its epoxide metabolite was higher in muscle fat than in hepatic or abdominal fat. Some possible mechanisms accounting for the disparity of residue concentrations in fat from various tissues are discussed. It is noted that residue concentrations were depleted by half at approximately 4 wk after cessation of exposure.

80-2241. Wagstaff, D. J.; Winston, F. B. (Bur. Vet. Med., US FDA, Beltsville, MD 20705) **Infrared photographic measurement of pupillary effects of dichlorvos in beagles.** *Am. J. Vet. Res.* 41(6): 958-959; 1980 (4 references).

Mature beagle dogs of both sexes were given oral doses of dichlorvos (DDVP) at rates of 13.5, 27, or 40.5 mg/kg. Infrared cinematography was used to measure pupillary response to a strobe flash. DDVP had little or no effect at any of the dose levels on the size of the resting pupil, regardless of the ambient light. No indication of miosis was found in dogs treated at the highest dose level. The pupillary response to the strobe light for dogs receiving the lowest dose of DDVP did not differ markedly from the base-line response during the experiment. In the dogs receiving the two larger dose levels, the pupil contracted to a smaller size than it had before treatment and recovered more slowly to the base-line diameter.

80-2242. Spehar, R. L.; Fiandt, J. T.; Anderson, R. L.; DeFoe, D. (Environ. Res. Lab., US EPA, Duluth, MN 55804) **Comparative toxicity of arsenic compounds and their accumulation in invertebrates and fish.** *Arch. Environ. Contam. Toxicol.* 9(1): 53-63; 1980 (39 references).

The toxicity of arsenic III (arsenic trioxide), arsenic V (arsenic pentoxide), sodium dimethyl arsenate, and disodium methyl arsenate (DMSA) to stoneflies, amphipods, and trout, and the bioaccumulation of these compounds were studied during a 28-day flow-through test. *Daphnia magna* were exposed for 21 days in static tests to determine life cycle effects. All animals were exposed to concentrations of approximately 100 and 1000 μg/l (as arsenic) of each of the compounds. Arsenic III, the most toxic compound, caused a significant reduction in the survival of amphipods at 1000 μg As/l after 7 days. None of the compounds significantly affected the survival of other test species after 28 days or reduced young production in *Daphnia* after 14 days of exposure. The concentration of

accumulated arsenic in stoneflies, snails, and *Daphnia* was as much as 131, 99, and 219 times greater than the water concentration, whereas amphipods and rainbow trout contained arsenic residues similar to the controls. Residues in stoneflies, snails, and *Daphnia* exposed to 1000 μg As/l were higher than those in animals exposed to 100 μg As/l, but appeared to reach a steady state after 14 days. Total arsenic accumulation was greatest in organisms exposed to inorganic arsenic, particularly at 100 μg/l. (Author abstract by permission)

80-2243. Montgomery, M. R.; Casey, P. J.; Valls, A. A.; Cosio, M. G.; Niewoehner, D. E. (Pulm. Toxicol. Lab., VA Med. Cent., Minneapolis, MN 55417) **Biochemical and morphological correlation of oxidant induced pulmonary injury: low dose exposure to paraquat, oxygen, and ozone.** *Arch. Environ. Health* 34(6): 396-401; 1979 (27 references).

The authors compared the temporal pattern of low dose oxidant induced lung injury in rats after exposure to either 1 ppm ozone or 100% oxygen for 24 hr or from treatment with paraquat (20 mg/kg, ip). Histological abnormalities in airways, parenchyma, and blood vessels were evaluated from coded and randomized sections and compared with appropriate controls. Drug metabolism by lung endoplasmic reticulum was studied in similarly treated rats as another index of lung injury. Exposure to oxygen caused no discernible morphological or biochemical abnormalities. Exposure to ozone caused histological lesions which appeared early and resolved by 7 to 14 days, whereas paraquat induced lesions were first evident at about 7 to 14 days. Abnormalities in drug metabolism followed a similar pattern. Low dose oxidant exposure from ozone and paraquat produce similar histological and biochemical lesions in rat lungs but with distinct temporal patterns. (Author abstract by permission)

80-2244. Kershaw, T. G.; Dhahir, P. H.; Clarkson, T. W. (Med. Serv. Branch, Thunder Bay, Ontario P7A 4L3, Canada) **Relationship between blood levels and dose of methylmercury in man.** *Arch. Environ. Health* 35(1): 28-36; 1980 (26 references).

The kinetics of blood deposition and clearance of methylmercury were measured in volunteers given a single meal of fish containing 18-22 μg mercury/kg body wt. Peak blood concentrations were achieved within 4 to 14 hr. Disappearance from blood was biphasic, with average half-times of 7.6 hr and 52 days, respectively. The fraction of the dose deposited in the blood volume after completion of tissue distribution was 5.9%. Blood concentrations of total mercury reached as high as 60 mg Hg/ml, whereas inorganic Hg did not exceed 2 ng Hg/ml. The average red blood cell to plasma concentration was 21 and the hair to blood deposition and clearance ratio was 292. The kinetic parameters relating to blood deposition and clearance were used to calculate the expected relationship between average long term daily intake of methylmercury and steady state blood concentration. (Author abstract by permission)

80-2245. Brenner, R. P.; Snyder, R. D. (EEG Lab., Vet. Admin. Med. Cent., Albuquerque, NM 87108) **Late EEG findings and clinical status after organic mercury poisoning.** *Arch. Neurol. (Chicago)* 37(5): 282-284; 1980 (15 references).

The family under study consumed meat from a pig that had been inadvertently fed seed grain treated with a methylmercury fungicide. A neurological disorder characterized by ataxia, agitation, decreased visual acuity, and decreased consciousness was recognized in the children, aged 8, 13, and 20 yr, 2 mo after the meat had been consumed. At the time of consumption, the mother was in the first trimester of pregnancy. At birth, the boy was tremulous with a weak cry and poor color. EEGs of the 4 siblings were recorded for periods of 2-8 yr. Various EEG abnormalities were noted in the siblings. The degree of EEG change reflected the clinical state. EEGs were also recorded on the mother and were found to be normal.

80-2246. Siegers, C. P.; Younes, M.; Oltmanns, D. (Inst. Toxikol., Luebeck, BRD) **Hemmende und foerdernde Einfluesse auf den Paracetamol-Metabolismus bei Ratten. [Inhibitory and stimulatory effects on the metabolic disposition of paracetamol in rats.]** *Arzneim. Forsch.* 30(5): 804-807; 1980 (22 references) (German).

Renal excretion of paracetemol (0.5 g/kg po) and its conjugates was increased in rats given phenobarbital or rifampicin. DDT (200 mg/kg in 10 ml/kg olive oil given ip 1 wk before paracetemol injection) and 3-methylcholanthrene did not elicit this response. The microsomal monoxygenase inhibitor DDC (dithiocarb; diethyl dithiocarbamate) was administered at a level of 100 mg/kg ip. Mercapturic acid conjugation was decreased significantly (38.1 ± 3.8% *vs.* 43.0 ± 5.7% for controls). Total urine volume decreased significantly from 13.9 ± 2.4 ml in controls to 6.3 ± 2.4 ml in DDC treated animals.

80-2247. Goerz, V. G.; Sick, N.; Vizethum, W.; Lissner, R.; Krieg, T. (Hautklin. Univ., Duesseldorf, BRD) **Einfluss von *p*-Aminobenzoesaure auf die Hexachlorbenzol induzierte Porphyrie der Ratte. [Influence of *p*-aminobenzoic acid on the hexachlorobenzene induced porphyria in the rat.]** *Arzneim. Forsch.* 30(5): 817-821; 1980 (28 references) (German).

The excretion of urinary porphyrins or precursors such as porphobilinogen or 5-aminolevulinic acid was not enhanced by the simultaneous application of hexachlorobenzene and *p*-aminobenzoic acid. There was also no change in these excretions when *p*-aminobenzoic acid was

applied after evidence of hexachlorobenzene induced porphyria was noted. Cytochrome P-450 content in rat livers was decreased by application of *p*-aminobenzoic acid. Hexachlorobenzene induced enzymatic activity of P-450 monooxygenase. Concentrations of glycine in the livers were not decreased by the simultaneous administration of the 2 compounds. It is suggested that there may be different types of human porphyria cutanea tarda. It is noted that the mainly exogenously induced PCT in men and the hexachlorobenzene induced porphyria in rats are not influenced by application of *p*-aminobenzoic acid.

80-2248. Pitot, H. C.; Sirica, A. E. (McArdle Lab. Cancer Res., Dep. Oncol., Med. Sch., Univ. Wisconsin, Madison, WI 53706) **The stages of initiation and promotion in hepatocarcinogenesis.** *Biochem. Biophys. Acta* 605(2): 191-215; 1980 (173 references).

This review covers the mechanisms for the latency period in the process of hepatocarcinogenesis. A brief recapitulation is offered of the more general aspects of the stages in tumor development as an introduction to the review. The two-stage process of carcinogenesis is defined with emphasis on the characteristics of initiation and promotion during skin carcinogenesis and the characterization of stages in carcinogenesis occurring in other tissues of the body. The various stages in the formation of hepatic carcinomas are reviewed with discussion given to preneoplastic lesions found in experimental studies and their relation to the development of hepatocarcinogenesis. The mechanisms of tumor promotion during hepatocarcinogenesis by chemicals, including DDT and PCBs, are discussed and applications of the two-stage process of hepatocarcinogenesis to problems found in human cancer are considered. The implications of the two-stage process of hepatocarcinogenesis in the monitoring and regulation of potential human carcinogens are outlined.

80-2249. Brown, E. A. B.; Maling, H. M. (Hypertension Endocr. Branch, Natl. Heart Lung & Blood Inst., Bethesda, MD 20205) **Effects of paraquat and related herbicides on the acetylcholinesterase of rat lung.** *Biochem. Pharmacol.* 29(3): 465-466; 1980 (10 references).

Homogenates were made of lung tissue from male Sprague-Dawley rats. Acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) inhibitions were measured in response to the exposure of the tissue homogenates to paraquat dichloride, diquat dibromide, or morfamquat dichloride. BChE activity was negligible in the rat lung homogenates used in this study. The findings suggest that, if paraquat is toxic in the lung tissue mainly due to the mechanism of AChE inhibition, the chemical must be assumed to be concentrated 100-fold in a compartment which contains AChE.

80-2250. Ireland, J. S.; Mukku, V. R.; Robinson, A. K.; Stancel, G. M. (Dep. Pharmacol., Med. Sch., Univ. Texas, Houston, TX 77025) **Stimulation of uterine deoxyribonucleic acid synthesis by 1,1,1-trichloro-2-(*p*-chlorophenyl)-2-(*o*-chlorophenyl)ethane (*o,p'*-DDT).** *Biochem. Pharmacol.* 29(11): 1469-1474; 1980 (27 references).

Immature female rats were given 250 to 1000 mg/kg *o,p'*-DDT. A maximum increase in uterine wet wt was produced. A maximum increase in DNA synthesis was measured by tritiated thymidine incorporation into uterine DNA over the 24 hr following treatment. *o,p'*-DDT produced long term increases in wet wt, DNA synthesis, total DNA content and protein content in the rat uterus. The chemical caused the same overall uterine response as 17β-estradiol after acute administration. Half-maximal responses were obtained using *o,p'*-DDT in the dose range of 10-40 mg/kg. The data support the theory that *o,p'*-DDT acts on the uterus by interacting with the uterine estrogen receptor. It is suggested that hyperplastic responses of estrogen target tissues, both normal and malignant, should be considered as one possible result of the toxic action of *o,p'*-DDT and related compounds.

80-2251. Hoffmann, R.; Erzberger, P.; Frank, W.; Ristow, H. J. (Med. Univ. Klin., Tuebingen, BRD) **Increased phosphatidylinositol synthesis in rat embryo fibroblasts after growth stimulation and its inhibition by δ-hexachlorocyclohexane.** *Biochim. Biophys. Acta* 618(2): 282-292; 1980 (36 references).

When resting rat embryo fibroblasts are stimulated to grow, a substantial increase in phosphatidylinositol synthesis can be observed. This increase cannot be explained by increased glucose uptake or glycolysis. δ-Hexachlorocyclohexane having the same configuration as myo-inositol, inhibits phosphatidyl-inositol synthesis as well as DNA synthesis and mitosis, but has no effect on phosphatidyl choline synthesis. When δ-hexachlorocyclohexane is added to fibroblast cultures during the first hours after stimulation, a delay of DNA synthesis and mitosis compared to uninhibited cultures can be observed. Since δ-hexachlorocyclohexane also inhibits the uptake of nucleotides, hexoses and amino acids, it it suggested that phosphatidylinositol is necessary for the proper functioning of those receptors and carriers which are an essential part of the early cellular processes after growth stimulation, and this role of phosphatidylinositol may explain its increased turnover in growing cells. The increased phosphatidylinostiol synthesis could not be associated to one of the subcellular fractions. When cells were labeled with [^{32}P]orthophosphate during the first 10 min after growth stimulation and were subsequently separated into cellular fractions such as nuclei, mitochondria, plasma membranes, and microsomes, no significant differences in radioactivity of phosphatidylinositol among those fractions could be observed. (Author abstract by permission)

80-2252. Maat, B. (Radiobiol. Inst., TNO, Rotterdam, The Netherlands) **Selective macrophage inhibition abolishes warfarin-induced reduction of metastasis.** *Br. J. Cancer* 41(2): 313-316; 1980 (30 references).

The effects of carrageenan and silica on warfarin-induced reduction of lung metastasis were investigated using Lewis lung carcinoma or B-16 melanoma. Groups of C57BL/Rij male mice were injected sc with viable tumor cells. Warfarin administration was begun on the day of transplant by ip injection of 2.5 mg/kg and followed by a daily oral dose in the drinking water until the end of the experiment. Iota carrageenan was given on days 0, 5, and 10 as an ip injection of 0.5 mg/mouse. Silica was injected ip at 25 mg/mouse on days 0 and 5. The animals were sacrificed on day 23 or day 28. In animals receiving carrageenan alone an increase was noted in lung metastases over controls. Warfarin-treated mice showed a drop in lung metastases, but a significant increase was seen in animals receiving carrageenan in addition to the warfarin regimen. The results of experiments with Lewis lung carcinoma did not differ from those with B-16 melanoma. With silica injections, the number of lung metastases was unchanged when compared to controls.

80-2253. Purchase, I. F. H. (Cent. Toxicol. Lab., Imp. Chem. Ind. Ltd., Alderly Park, Cheshire, England) **Inter-species comparisons of carcinogenicity.** *Br. J. Cancer* 41(3): 454-468; 1980 (8 references).

The published literature was consulted to obtain results of carcinogenicity studies conducted on 250 chemicals (including pesticides) in 2 species, in most cases the rat and mouse. References and opinions on carcinogenicity were obtained from the National Cancer Institute Bioassay Program, the International Agency for Research on Cancer, and U. S. Public Health Service Document No. 149. Of the 250 chemicals on the list 38% were non-carcinogenic in both rats and mice and 44% were carcinogenic in both species. Different results in the two species were obtained for 43 compounds, 21 were carcinogenic in mice only, 17 in rats only and for 5 results differed from other species. In 64% of the compounds the target tissues in both species were the same. It is suggested from this comparison study that the practice of extrapolating from results in a single animal study to man may cause significant error.

80-2254. Butler, W. H. (Pharmaceut. Div., ICI Ltd., Alderley Park, Cheshire, England) **Hepatic nodular lesions in rats and mice: their significance.** *Br. J. Cancer* 41(3): 505-506; 1980 (8 references).

Problems encountered in interpretation of focal proliferative lesions in rats and mice are considered. Proliferations of parenchymal cells in mice have a structure which very often resembles normal liver. While these lesions are not associated with invasion and metastasis, they have been thought to be hepatomas, adenomas, carcinomas or focal nodular hyperplasia. A wide range of proliferative lesions have been studied. Many are induced by chemical carcinogens and consist of foci of proliferating hepatocytes with starvation-resistant glycogen in an otherwise normal liver. Chlorinated pesticides cause lesions in test species that cannot be classified as malignant neoplasia by conventional criteria. However, these chemicals are considered to be carcinogens. It is suggested that standard rigorous criteria be adopted for assessing chronic pathological effects to improve the predictive value of current tests in recognizing possible hazards to man.

80-2255. Turner, J. C.; Shanks, V. (Wallaceville Anim. Res. Cent., Res. Div., Minist. Agric. & Fish., Upper Hutt, New Zealand) **Adsorption of some organochlorine compounds by the rat small intestine - *in vivo*.** *Bull. Environ. Contam. Toxicol.* 24(5): 652-655; 1980 (10 references).

Intestinal loops were prepared from male Wistar rats. The loops were injected with 0.4 ml of a solution of an organochlorine compound (DDT, hexachlorobenzene, lindane or PCBs) dissolved in rat bile. The organochlorine pesticide compounds were used at concentrations of 0.05 or 0.10 μmol/0.4 ml bile. PCBs were injected as an equimolar mixtures of either 0.05 or 0.10 μmol. Lindane was rapidly absorbed. The PCB compounds exhibited a decrease in absorption as the chlorine content of the compound increased. About 10% of the tetrachloro compound injected was absorbed, about 4% of the pentachloro compound, and only 0.9% of the heptachloro compound. The compounds which were more lipid-soluble were also absorbed into the lymphatic system, whereas the least lipid-soluble compound, lindane, was only detected in trace amounts in the lymph of some of the rats. Highly chlorinated biphenyls were more readily absorbed by the lymphatic system than were less chlorinated biphenyls. It is suggested that careful interpretation of gas chromatogram profiles is necessary since highly chlorinated biphenyls were absorbed via the lymphatic system as well as via the blood system.

80-2256. Wayne, G.; Oehler, D. D. (Vet. Toxicol. & Entomol. Res. Lab., Agric. Res., SEA, USDA, College Station, TX 77840) **Fate of dicyclopentadiene in a lactating cow.** *Bull. Environ. Contam. Toxicol.* 24(5): 662-670; 1980 (3 references).

When given by oral administration to lactating cows, DCPD (an organochlorine insecticide waste product) was subject to rapid and extensive metabolism. The urine and feces contained 86% of the administered dose with only trace amounts being secreted in the milk. It is suggested that some of the administered DCPD may have been eliminated in a gaseous form due to the high volatility of the chemical. The compound was extensively absorbed from the gastrointestinal tract. None of the chemical was detected in tissue samples. However, the possibility that

such residues were indeed present cannot be ruled out due to the volatility of DCPD. Metabolites present in the urine were mainly in the form of glucuronide conjugates. It is suggested that epoxidation of one or both of the DCPD double bonds occurred, followed by hydrolysis of the epoxides to diols and then ultimate conjugation with glucuronic acid. It is suggested that low-level exposure of ruminants to DCPD will not result in retention of appreciable residue in tissues or in their secretion into milk. Thus significant toxicological hazard is not likely to occur.

80-2257. Zinkl, J. G.; Roberts, R. B.; Henny, C. J.; Lenhart, D. J. (Dep. Clin. Pathol., Univ. California, Davis, CA 95616) **Inhibition of brain cholinesterase activity in forest birds and squirrels exposed to aerially applied acephate.** *Bull. Environ. Contam. Toxicol.* 24(5): 676-683; 1980 (8 references).

Plots of the Payette National Forest were sprayed with 0.57 kg AI acephate/ha by helicopter. Birds and mammals were collected between 3 and 6 hr after spraying and on days 1, 3, 6, 25, and 26. On the day acephate was applied, 11 of 22 birds showed depressed brain cholinesterase (ChE) activities. One day later 14 of 26 exhibited depressed ChE, at 3 days had ChE was depressed in 13 of 14, and at days 25 and 26, 3 of 19 had depressed ChE. Maximum depression occurred in a chipping sparrow 6 days after spraying, 57%. Residue analysis for acephate and methamidophos in brains of western tanagers, dark-eyed juncos and Swainson's thrushes indicated that only a western tanager collected on day 0 and one from day 3 contained detectable residues in the brain. Two Columbian ground squirrels collected on day 3 and one on day 6 had acephate residues in the brain.

80-2258. Sahib, K. A.; Rao, K. V. R. (Dep. Zool., S.V. Univ., Tirupati 517502, A.P., India) **Correlation between subacute toxicity of malathion and acetylcholinesterase inhibition in the tissues of the teleost *Tilapia mossambica*.** *Bull. Environ. Contam. Toxicol.* 24(5): 711-718; 1980 (12 references).

Fishes exposed to sublethal (2 mg/l) concentrations of malathion experienced significant decreases in AChE (acetylcholinesterase) activity. Brain AChE showed the highest inhibition at 47.8%, followed by muscle at 45.9%, gill at 39.1%, and liver tissues at 35.4%. Since the differential inhibiton of AChE by malathion represents differences in sensitivity of four tissues, the brain thus exhibited the highest sensitivity. When different concentrations of eserine were tested on AChE of normal tissues, 0.03 m*M* in the brain, 0.026 m*M* in muscle, 0.02 m*M* in the gill and 0.016 m*M* in liver produced the same percentage of inhibition of AChE as in the respective tissues of malathion exposed fishes. Brain tissue therefore has a relatively higher degree of innervation and needs a higher concentration of eserine than muscle, gill or liver tissues. It is suggested that the competitive inhibition obtained by eserine and malathion may be due to their resemblance with acetylcholine.

80-2259. Farquharson, D. A.; Hoskin, F. C. G.; Hubbard, K.; Prusch, R. D. (Dep. Biol. Illinois Inst. Technol., Chicago, IL 60612) **Penetration of VX into nerve cells, and effects on electrical function.** *Bull. Environ. Contam. Toxicol.* 24(5): 719-726; 1980 (28 references).

VX [*O*-ethyl *S*-(2-diisopropyl aminoethyl) methyl phosphono fluoridate] apparently penetrates cells by penetrating connective, Schwann, and basement layers, and finally the axonal membrane itself in the unprotonated form, accumulating inside in the protonated form. The pH at equivalent distribution was the intracellular pH of the squid giant axon. This appeared to be about 7.3. With intact eel electroplaques a significant and easily measurable amount of esterase remained even at a VX concentration four orders of magnitude higher than that which caused complete inhibition of purified eel AChE in solution. Signs of VX toxicity in the squid were what one would expect with receptor inhibition, as well as with the more demonstrable AChE inhibition. The study indicated that the handling and disposal of VX and similar phosphonothiolo compounds is complicated by their ability to accumulate within cells, by their stability and by their ability to interact with cholinergic receptors as well as by their inhibition of AChE.

80-2260. Dikshith, T. S. S.; Raizada, R. B.; Datta, K. K. (Ind. Toxicol. Res. Cent., Lucknow 226001, India) **Response of female guinea pigs to repeated oral administration of quinalphos.** *Bull. Environ. Contam. Toxicol.* 24(5): 739-745; 1980 (14 references).

Female guinea pigs, exposed to quinalphos at 0.5, 1.0 or 2.0 mg/kg/day for 15 and 30 days, exhibited no symptoms of poisoning or overt toxicity. Animals doses at 4.0 mg/kg/day exhibited severe symptoms including tremor, salivation, convulsion and death. Animals died irregularly within 7 days of dosing. No changes were noted in liver wt of animals receiving 0.5, 1.0, or 2.0 mg/kg/day. However, a significant decline in the kidney wt and a slight increase in adrenal wt were noted. The weights of the ovaries were significantly lowered by all treatments except for the 0.5 mg/kg/day level. No changes were noted in uterine wt. No significant pathological changes were noted. Acetylcholinesterase activity was inhibited more than 70% in all treatments. It is suggested that occupational workers who are exposed to organophosphorus sprays and formulations should be given rest at regular intervals to avoid dangers from organophosphorus intoxication.

80-2261. Cardinal, H.; Vernet, G.; Sinegre, G. (Lab. Physiol. Invert., Univ. Sci. & Tech. Languedoc, F-34060

Montpellier, France) **Quelques effets d'un inhibiteur de croissance: le Diflubenzuron sur un crabe *Carcinus mediterraneus* (Czerniavsky). [Some effects of a growth inhibitor: diflubenzuron on the crab *Carcinus mediterraneus* (Czerniavsky).]** *C. R. Seances Soc. Biol. Paris* 173(6): 1105-1108; 1979 (8 references) (French).

A common crab of Languedoc coastal ponds was exposed to sea water contaminated at two concentrations, 0.2 and 0.02 ppm, with difubenzuron. Mortality increased with increasing concentrations. Mortality at molting may have resulted from alterations in the formation of the new exoskeleton. The cuticle demonstrated the absence of resorption of the old integument and the new exocuticle showed malformations.

80-2262. Carricaburu, P.; Lacroix, R.; Lacroix, J. (Dep. Physiol. Humaine, Fac. Med. Paris Quest, F-75270 Paris cedex 06, France) **Etude de l'influence de pesticides organochlores chimiquement apparentes sur la reponse electrique oculaire de la Souris blanche. [Study of the influence of the chemical structure of organochlorine pesticides on the electric ocular response of the white mouse.]** *C. R. Seances Soc. Biol. Paris* 173(6): 1155-1160; 1979 (9 references) (French).

The organochlorine pesticides chlordane, aldrin and dieldrin were shown to act on the bipolar neurones and the repolarization of the photoreceptors. Dieldrin and aldrin disturbed photoreceptor excitability, whereas chlordane did not. The results obtained in this study, coupled with those from earlier studies on the effects of DDT and HCH (BHC), prove the relation between chemical structure and retinian toxicity.

80-2263. Roush, R. T.; Peacock, W. L.; Flaherty, D. L.; Hoy, M. A. (Dep. Entomol., Univ. California, Berkeley, CA) **Dimethoate-resistant spider mite predator survives field tests.** *Calif. Agric.* 34(5): 12-13; 1980.

A strain of *Metaseiulus occidentalis* was selected for dimethoate resistance. This resistance was further increased until a strain was selected which was more resistant to dimethoate than any which occur naturally. This selected strain was then released into an Italia grape vineyard near Dinuba, Tulare County, to test its ability to survive a dimethoate application. It was hoped that sufficient numbers would survive for spider mite control. Laboratory studies indicated that the dimethoate resistance was due to several genes acting together. These field studies indicate that laboratory selected predators are able to colonize in vineyards and that higher levels of laboratory-induced resistance can persist in nature. Unfortunately, at present, the level of resistance in this selected strain is not high enough to withstand dimethoate treatment and survive in numbers great enough to control spider mites.

80-2264. Colwell, A. E.; Schaefer, C. H. (Lake Cty. Mos. Abatement Dist., Lakeport, CA 95453) **Diets of *Ictalurus nebulosus* and *Pomoxis nigromaculatus* altered by diflubenzuron.** *Can. J. Fish Aquat. Sci.* 37(4): 632-639; 1980 (26 references).

Five experimental ponds were treated with the insect growth regulator diflubenzuron at a mean concentration of 13 μg/l. Residues decreased rapidly, and by 14 days after spraying were below detectable limits in most ponds. *Ceriodaphnia* sp., *Diaphanosoma* sp., *Chydorus* sp., *Bosmina* sp., and *Daphnia* sp. all experienced population reductions after spraying. Most cladoceran densities recovered slowly. Among copepod populations the abundance of nauplii decreased following treatment and returned to normal in 7 days to 4 wk time. The detritivorous rotifers present increased in abundance during the first 8 days after spraying. A similar increase was noted in the *Asplanchna* sp. Young of the year black crappie and brown bullhead accumulated diflubenzuron but eliminated all residues by 7 days post-treatment. Fish mortalities did not occur, but major chan,,es in the diets of fish were noted 1 mo after treatment. Growth of fishes in the treated ponds was similar to controls.

80-2265. Tu, J. C.; McNaughton, M. E. (Res. Stn., Res. Branch, Agric. Canada, Harrow, Ontario NOR 1GO, Canada) **Isolation and characterization of benomyl-resistant biotypes of the delta race of *Colletotrichum lindemuthianum*.** *Can. J. Plant. Sci.* 60(2): 585-589; 1980 (11 references).

Thirteen biotypes resistant to benomyl and which were capable of radiating mycelial growth on Mathur's agar (MA) containing 500 μg/ml of benomyl were isolated from race delta of bean anthracnose *(Colletrotrichum lindemuthianum).* The resistance was of a persistent type, resistant characteristics being retained after several subculturings on benomyl-free MA. Several biotypes lost virulence totally or partially while the others increased in virulence. In additon, individual biotypes differed in pathogenicity towards various susceptible cultivars. The cultural characteristics, sporulation and growth differed among the biotypes and also from the original delta race. Pathogenicity generally was correlated positively for the virulent biotypes with the amount of sporulation. The significance of the development of the resistant biotypes and the use of bneomyl in seed treatment to control bean anthracnose is discussed. (Author abstract by permission)

80-2266. Heinonen, P. K. (Dep. Biomed. Sci., Univ. Tampere, SF-33101 Tampere 10, Finland) **Effects of cycloheximide and streptolydigin on avidin induction in the chick oviduct.** *Comp. Biochem. Physiol. C* 66(8): 83-85; 1980 (19 references).

Two or 3-day-old Leghorn chicks were injected sc with 50 mg progesterone in 1 ml of prolylene glycol/kg body wt. Streptolydigin (0.5 to 10 mg/kg) and cycloheximide (0.1 to 2 mg/kg) were administered ip 5 min after progesterone or ligation treatment. Animals were sacrificed 24 hr after treatment. Cycloheximide had a dose-dependent inhibitory effect on avidin by progesterone. The inhibition was most pronounced in doses of 0.8 and 1 mg/kg of cycloheximide. Cycloheximide at 1 mg/kg given alone had no significant effect of avidin. Avidin induced by progesterone or ligation could not be significantly inhibited by streptolydigin in the dose range used. This inhibitor alone had no effect on avidin. A dose of 10 mg/kg streptolydigin killed all animals during the experiment. It is suggested as possible that RNA polymerases in eucaryotic cells are resistant to streptolydigin or that the necessary doses are lethal *in vivo*.

80-2267. Pincus, J. F. (State Univ. New York, Stony Brook, NY) **Pesticide inhibition of Na-K ATPase.** *Diss. Abstr. Int. B* 40(11): 5115; 1980.

The pesticide Kepone (chlordecone) has been shown to inhibit the Na-K ATPase obtained from the electric organ of *Electrophorus electricus*. The rate of inhibition is markedly biphasic; the slow phase of inhibition is affected by preincubation of enzyme with substrate or ions. Kepone can be sequestered in pure phospholipid vesicles and induces changes in the vesicular appearance of the ATPase preparation, was well as decreasing the membrane fluidity in this preparation. The interaction of Kepone with the phospholipid matrix is proposed as the basis for the marked dependence of inhibition at fixed Kepone levels on enzyme concentration. Though Kepone can totally inhibit the catalytic activities of ATP and pNPP hydrolysis and enzyme phosphorylation, submaximal levels of this pesticide also appear to alter binding of substrates and activating cations, while still permitting residual catalytic activity. The effects of Kepone on cation activation provide further evidence that the Na+ sites in the ATPase reaction are the same as the K^+ sites in the pNPPase reaction when Na^+ and ATP are absent. Furthermore, the effects on substrate binding support the conclusion that the low affinity ATP site is the same as the pNPP site. Kepone inhibits the binding of ouabain and increases the rate of dissociation of ouabain once bound. In terms of a dimer model of Na-K ATPase, Kepone seems to be acting at and altering the asymmetric dimeric conformation of the enzyme. (Author abstract by permission. Copies of the thesis are available from University Microfilms, order No. 8011343)

80-2268. DeVries, D. H. (Univ. California, Riverside, CA) **Mechanisms of resistance to pyrethroid insecticides in a *trans*-permethrin selected strain of the house fly, *Musca domestica* L.** *Diss. Abstr. Int. B* 40(11): 5133; 1980.

A fenthion-resistant strain of the house fly (*Musca domestica* L.) was selected with (+)-*trans*-resmethrin resulting in *ca.* 90-fold resistance to the selecting agent. This strain was subsequently selected with (+)-*trans*- and (±)-*trans*-permethrin producing *ca.* 140-fold resistance to this insecticide. The permethrin-resistant strain was cross-resistant to all of the 26 pyrethroid insecticides which were tested against it as well as to DDT and a DDT analog. Approximately 12-fold synergism was obtained with a mixture of (+)-*trans*-permethrin:pb (1:5), however, no synergism was found with the esterase inhibitor DEF. An investigation of the microsomal components revealed that the resistant (R) strain possessed a 2-fold increase in the level of cyt P450 and cyt b_5 and in the rate of NADPH-cyt *c* reductase activity as compared to the susceptible (S) strain. The sensitivity of the central nervous system to 4 pyrethroids was investigated. The R strain was 2.6-fold less sensitive to (±)-*trans*-ethanoresmethrin than the S strain and > 43-fold and > 67-fold less sensitive to tetramethrin and (±)-*trans*-permethrin, respectively. The results indicate that the major mechanisms for pyrethroid resistance in this strain are: decreased sensitivity of the site of action, possibly due to a *kdr* type mechanism; decreased penetration of the insecticide into the insect; and a slightly greater rate of metabolism of the pyrethroids. The most important mechanism is probably the site-insensitivity. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 8010438)

80-2269. Murray, H. E. (Sch. Public Health, Health Sci. Cent., Univ. Texas, Houston, TX) **Effects of selected insecticides on native populations of aquatic microorganisms.** *Diss. Abstr. Int. B* 40(11): 5189; 1980.

Use of Sevin (carbaryl), Spectracide (diazinon), and malathion for control of mosquitoes and a variety of crop pests provides ample opportunity for addition of these chemicals to surface water directly from sprays, or in surface run-off. The overall effects of small concentrations of these pesticides on indigenous populations of aquatic microorganisms have been studied. Water was brought from Lake Houston, placed in four 19 *l* aquaria and allowed to stabilize to room temperature (21 ± 2°C) for 1 wk. Water was circulated from one end of each aquarium to the other by use of tygon tubing and a continuous flow pump. Evaporation losses were reduced by covering the aquaria with foil, and were replaced by autoclaved water from the same source. Two aquaria served as controls. Sevin, Spectracide and malathion were each added to aquaria after population levels had been determined. Total culturable heterotrophic bacteria were studied by plate counts, Warburg respirometry, ATP, and BOD determinations. Algae were studied by microscopic counts, light-dark bottle respiration, ATP determinations, dry wt and ash-free wt determinations of biomass, and carbon analyses. No effect of pesticides on any population was detected at a concentration less than 1 mg/l. Among effects observed were early stimulation of bacterial metabolism and growth

by 5 mg/l Sevin and 1-naphthol, and of early suppression of total algae numbers with recovery of these total numbers by 14 days. Malathion had less effect on these populations, and both bacterial and algal populations appeared to be unaffected by Spectracide at 5 mg/l. (Author abstract by permission. Copies of the thesis are available from University Microfilms, order No. 8010904)

80-2270. Oladimeji, A. A.; Qadri, S. U.; Tam, G. K. H.; DeFreitas, A. S. W. (Dep. Biol., Fac. Sci. & Eng., Univ. Ottawa, Ottawa, Ontario, Canada) **Metabolism of inorganic arsenic to organoarsenicals in rainbow trout *(Salmo gairdneri)*.** *Ecotoxicol. Environ. Saf.* 3(4): 394-400; 1979 (21 references).

Rainbow trout were dosed with 20 μCi ^{74}As added to 500 mg pulverized trout chow in a No. 4 gelatin capsule. At 0.5, 6, 12, 24, and 96 water and put in a polyethylene bag. Radioactivity in live fish was water and put in a polyethylene bag. Radioactivity in live fish was measured with a single channel γ counter equipped with 3 × 3 in. sodium iodide detector crystal. Tiussue and blood samples were also taken. Arsenic was detected in blood samples 6 hr post-dose. At 96 hr the total arsenic radioactivity of the blood was ~ 40% of its 24 hr value. The ratio of total organic to inorganic arsenic increased with time in muscle, kidney, and bile extracts as well as in blood, with the organic arsenic fraction accounting for 34-64% at 6 hr and over 90% after 24 hr. More than 70% of the arsenic excreted in urine 12 hr post-dosing was inorganic, the rest being organic. By 96 hr essentially all urinary arsenic was organic. However, the urinary and biliary routes accounted for only a minor portion of the total excretion. It is suggested that one route for excretion of inorganic arsenic could be the gills.

80-2271. Ford, R. D.; Rosenblum, I. (Inst. Comp. & Human Toxicol., Albany Med. Coll., Union Univ., Albany, NY 12208) **The acute behavioral effects of diisopropyl fluorophosphate in the chicken, pigeon, and rhesus monkey.** *Ecotoxicol. Environ. Saf.* 3(4): 428-438; 1979 (12 references).

Chickens and pigeons received a multiple fixed-ratio, fixed-interval schedule of food presentation and were exposed to DFP by both oral and im injection routes. Both routes of administration were also studied in chickens kept on a multiple fixed-ratio, time-out schedule of food presentation. A rhesus monkey kept under a chain fixed-ratio, fixed-ratio schedule of sucrose presentation was exposed to DFP via im injection. A general depression was noted among animals on the response to the fixed-ratio, fixed-interval, and time-out schedules with no mean increases in response rates. Behavioral effects were accompanied by acute cholinergic effects in both the chicken and rhesus monkey. The species and the route of administration both affect the duration of DFP effects. The most sensitive of the tested animals was the monkey; the lowest im dose, 0.1 mg/kg, disrupted responding in the chicken in a dose-related manner beginning at 0.25 mg/kg. Potency was the same in the pigeon by either route.

80-2272. Megaw, M. (Sharpstow Chem. Co. Ltd., Berkhamsted, Hertfordshire, England) **Pyrethroid formulations for insect pest control.** *Environ. Health* 88(4): 83, 84, 86; 1980.

The use of pyrethroid formulations for insect control is reviewed. The necessity for insecticides which are safe for non-target organisms is discussed. It is recommended that pesticides that are to be used around foodstuffs should be non-persistent and safe for humans. The toxicity to rats of the natural pyrethrins, synthetic analogs of pyrethrum, and several insecticides are presented in tabular form. Natural pyrethrins have an acute oral toxicity dose of 584-900 mg/kg and an acute dermal toxicity dose of > 1500 mg/kg. Values for synthetic pyrethrins range from 134 to 8000 mg/kg and 784 to > 10,000 mg/kg, respectively. These values are compared with several common insecticides (DDT, lindane, diazinon, propoxur, fenitrothion, and bendiocarb). The acute oral toxicity dose for bendiocarb is 64 mg/kg, and the acute dermal toxicity dose is 800 mg/kg. The acute oral toxicity dose for diazinon is 850 mg/kg. The acute dermal toxicity dose for fenitrothion is 3000 mg/kg. The use of synthetic pyrethrins is also discussed. It is suggested that suitable combinations of pyrethroids will emulate the effects of the natural pyrethrum extract.

80-2273. Schiller, C. M. (Lab. Organ. Funct. & Toxicol., NIEHS, Research Triangle Park, NC 27709) **Chemical exposure and intestinal function.** *Environ. Health Perspect.* 33: 91-100; 1979 (26 references).

The evaluation of intestinal function effects caused by various chemicals present in the environment is discussed. The effects can be evaluated by studying *in vivo* or *in vitro* exposure, followed by monitoring of these effects. Exposure to the herbicide contaminant TCDD, even in minute quantities, causes changes in intestinal function. TCDD-mediated induction of UDP-glucuronyl transferase was monitored in cells taken from the tip and crypt regions of the intestines. Adult female rats were fasted for 16 hr and fed *ad libitum* after receiving a single oral dose of TCDD at 8 μg/kg. After 10 hr the tip cell glucuronyl transferase activity increased by 20%, and a 50% increase in activity occurred in crypt cells. This suggested a more general sensitivity of undifferentiated cells to inductive agents. Cellular distribution of the activity in the isolated tip and crypt cells was not investigated nor was the chemical nature of the material present.

80-2274. Pritchard, J. B.; James, M. O. (Lab. Pharmacol., NIEHS, Research Triangle Park, NC 27709)

Factors determining the rate of excretion of anionic xenobiotics. *Environ. Health Perspect.* 33: 326; 1979.

DDA, 2,4-D and phenylacetic acid were readily accumulated by isolated tubules of winter flounder (*Pseudopleuronectes americanus*). At concentrations of 10 μM, tissue: medium ratios ranged from 9 for phenylacetic acid to 29 for 2,4-D. Metabolic inhibitors markedly reduced uptake. Plasma binding modified the rate of transport and excretion of the chemicals. *In vitro*, the addition of plasma to the medium inhibited uptake of DDA and 2,4-D, but was far more effective with DDA. It is suggested that metabolism may also change the excretion rate. No direct evidence was obtained indicating that the taurine conjugates are more poorly excreted than their parent compounds. It is concluded that differences between species and compounds may be explained primarily by differences in their renal transport, as modified by binding to plasma proteins.

80-2275. Pritchard, J. B.; Holliday, C. W.; Neufeld, G. J. (Lab. Pharmacol., NIEHS, Research Triangle Park, NC 27709) **Gill Na^+,K^+-ATPase, osmoregulation, and DDT toxicity in the blue crab.** *Environ. Health Perspect.* 33: 326; 1979.

The biochemistry and osmoregulatory effects of crab gill Na^+K^+-ATPase were studied. Na^+,K^+-ATPase was inhibited by DDT at a concentration of 1 ppm *in vitro*. At 9 ppm 30-40% inhibition was achieved. Inhibition of the enzyme was similar regardless of whether the crabs tested were 100% seawater crabs or had been previously adapted to dilute seawater. A transient fall in hemolymph osmolality was produced during *in vivo* testing using DDT concentrations of 0.3 ppm. [Presented at the NIEHS Second Biennial Sci. Seminar]

80-2276. Welling, P. G. (Univ. Birmingham, Birmingham, England) **Drug kinetics.** In: *Foreign Compound Metabolism in Mammals. A specalist periodical report.* Hathaway, D. E., ed. (Chemical Society: London) 5(CH01): 1-88; 1979 (758 references).

A review of drug kinetics is presented which covers drug absorption and bioavailability, drug distribution and elimination, clinical pharmacokinetics and narcotic analgesics. Some drugs discussed include those acting on the CNS, cardiovascular system, neuromuscular junctions, synaptic sites, blood, and blood forming organs. Warfarin, a drug acting on serum proteins, has received considerable attention in recent years. In patients with renal impairment, the binding of warfarin to serum protein may be decreased. Warfarin serum protein binding is also reduced in the presence of naproxen. Other drugs affecting warfarin protein binding are mentioned. Kinetics of antihypertensive agents, bronchodilators, sympathomimetic and hypoglycemic agents, and local anesthetics are considered. The actions of several antibiotics and antimicrobial, antifungal and antiprotozoal agents are discussed. Chemotherapy drugs, steroids, prostaglandins and some general anesthetics are examined. The kinetics of ethanol, some inorganic ions, diagnostic drugs and other miscellaneous compounds are also reviewed.

80-2277. Bentley, P.; Oesch, F. (Cent. Toxicol. Lab., I.C.I. Ltd., Alderley Park, Cheshire, England) **Enzymic mechanisms of oxidation, reduction, and hydrolysis.** In: *Foreign Compound Metabolism in Mammals. A specialist periodical report.* Hathaway, D. E., ed. (Chemical Society: London) 5(CH02): 89-131; 1979 (375 references).

Enzymic conversions of foreign compounds through oxidative, reductive, and hydrolytic mechanisms are reviewed. Particular attention is paid to the microsomal monoxygenases, cellular distribution of cytochrome P450-dependent monooxygenases, and the properties, purification and activation of the cytochrome P450-dependent monooxygenases. The metabolism of parathion to paraoxon by liver microsomes is discussed to illustrate the oxidation at sulfur. During parathion metabolism by a reconstituted system, sulfur is bound mainly to a cysteine residue of cytochrome P450, while in microsomes, most of the protein-bound sulfur is precipitated by antibodies to cytochrome P450. Highly pure hepatic cytochromes P450 have been obtained from rabbits pre-treated with TCDD. The binding of TCDD to receptor sites for aryl hydrocarbon hydroxylase has been investigated extensively in cytochrome P450 induction studies. The reduction of carbonyl groups, epoxide and *N*-oxide reduction, and the reduction of polyhalogenated methanes and other substances are covered. The epoxide hydratase system of hydrolysis is outlined in detail and other hydrolytic activities used in foreign compound metabolism are also examined.

80-2278. Hirom, P. C.; Milburn, P. (NIEHS, Research Triangle Park, NC) **Enzymic mechanisms of conjugation.** In: *Foreign Compound Metabolism in Mammals. A specialist periodical report.* Hathaway, D. E., ed. (Chemical Society: London) 5(CH03): 132-158; 1979 (181 references).

The purification of UDP-glucuronyltransferase has advanced the understanding of the biochemical role of glutathione in the metabolism of foreign compounds. Glucuronic acid conjugation, glutathione *S*-transferase, and amino acid conjugations are reviewed as well as new conjugation reactions. 2,4-D and 2,4,5-T have been found to undergo a substantial taurine conjugation in fish. The pyrethroid insecticide cypermethrin is also metabolized by taurine conjugation *in vivo* to 3-phenoxybenzoyltaurine. Alanine and serine conjugates of bis(*p*-chlorophenyl) acetic acid (DDA), a DDT metabolite, have been found in small amounts in both mouse and hamster urine. Other studies

have shown that glutamic acid conjugation occurs in the metabolism of permethrin.

80-2279. Baty, J. D. (Univ. Dundee, Dundee, Scotland) **Species, strain, and sex differences in metabolism.** In: *Foreign Compound Metabolism in Mammals. A specialist periodical report.* Hathaway, D. E., ed. (Chemical Society: London) 5(CH04): 159-189; 1979 (102 references).

Many species, strain and sex differences in the metabolism of foreign compounds have been documented. This brief review of some species differences includes comparisons of catabolic reactions, conjugation, biliary excretion and enzyme activity. The pharmacogenetics of sex and strain differences are also outlined. DDT metabolism was different in CF-1 mice and the Syrian hamster. The major urinary metabolites in both species were conjugates of bis(*p*-chlorophenyl)acetic acid. The mouse urine also contained small amounts of DDE. Minor qualitative differences and substantial quantitative differences were noted in the hydroxylation patterns of biphenyl in the rat, rabbit and guinea pig. The main metabolite in these three species was 4-hydroxybiphenyl. In studies on 16 strains of mice, piperonyl butoxide lengthened hexobarbitone sleeping times, but had no effect on zoxazolamine paralysis times. Pretreatment of the mice with either phenobarbital or piperonyl butoxide had no effect on warfarin survival. A genetic influence in plasma protein binding has been found for the binding of racemic warfarin.

80-2280. Hathaway, D. E. (Cent. Toxicol. Lab., I.C.I. Ltd., Alderley Park, Cheshire, England) **Mechanisms of chemical carcinogenesis.** In: *Foreign Compound Metabolism in Mammals. A specialist periodical report.* Hathaway, D. E., ed. (Chemical Society: London) 5(CH05): 190-243; 1979 (358 references).

The mechanisms of chemical carcinogenesis are outlined to elucidate the subject of metabolism of foreign substances. Carcinogenesis by alkylating agents, nitrosamines, hydrazines, triazenes, aromatic hydrocarbons, and naturally occurring compounds is examined. Bladder carcinogenesis due to the aromatic amines is explained and research on the inhibition of tumor initiation is reviewed. Aflatoxins are discussed among the many naturally occurring substances which cause cancer in laboratory animals. Dichlorvos gave negative tests of mutagenicity and carcinogenicity in mammals. These findings supported other experiments showing the inability of dichlorvos to methylate the N-7 position of DNA and RNA guanine residues of rats that had been exposed to atmospheric levels (0.064 μg/l) of the pesticide.

80-2281. Rhodes, C. (Pharm. Div., I.C.I. Ltd., Alderley Park, Cheshire, England) **Cardiovascular drugs.** In: *Foreign Compound Metabolism in Mammals. A specialist periodical report.* Hathaway, D. E., ed. (Chemical Society: London) 5(CH07): 320-348; 1979 (140 references).

The cardiovascular drugs are discussed in this extensive review of foreign compound metabolism. Warfarin, an anticoagulant, undergoes several biotransformations including hydroxylation of the coumarin and phenyl rings, ketone reduction to the diastereomeric alcohols, ring closure to form the cyclic ketal, and side-chain hydroxylation. Metabolism of antithrombolytic agents, hypolipidemics and hypercholesteremic drugs are also considered. The metabolism by mammals of some of the compounds used in the treatment of hypertension and cardiac disorders is examined.

80-2282. Bedford, C. T. (Shell Res. Ltd., Sittingbourne, Kent, England) **Agricultural chemicals.** In: *Foreign Compound Metabolism in Mammals. A specialist periodical report.* Hathaway, D. E., ed. (Chemical Society: London) 5(CH12): 436-494; 1979 (207 references).

The metabolism of animal health products, insecticides, herbicides, fungicides and rodenticides are reviewed. Three ureas from chlordimeform, a phenol from *p,p'*-DDE (with the OH group in the position of a *p*-chloro group), benzene from phenyl hydrazide, semicarbazide from *N*-phenylsemicarbazide, *N*-dearylation, and a 9- or 10-dechlorinated derivative of mirex have recently been identified. Reductive dechlorination of DDT, mirex and toxaphene has been demonstrated and the cytosolic α-BHC dechlorinase of rat liver has been purified. The bioinorganic chemistry of DDT is reviewed. While DDT undergoes mainly reductive dechlorination, lindane is usually biotransformed via oxidative pathways. Paraquat initially undergoes a reductive biotransformation to yield a paraquat radical plus singlet oxygen. The oxygen then oxidizes the radical back to paraquat. Chlorinated dioxins may also revert to reactive radicals during their metabolism. The mechanisms of transformation of 44 pyrethroids and 20 model compounds by mouse liver microsomes has been extensively researched and is fairly well delineated.

80-2283. Bedford, C. T. (Shell Res. Ltd., Sittingbourne, Kent, England) **Industrial chemicals and miscellaneous organic compounds.** In: *Foreign Compound Metabolism in Mammals. A specialist periodical report.* Hathaway, D. E., ed. (Chemical Society: London) 5(CH13): 495-523; 1979 (181 references).

The metabolism of industrial chemicals and other miscellaneous compounds are discussed according to their structural classifications. The major categories outlined include the aliphatic, aromatic, and heteroaromatic compounds, and some organometallic and inorganic substances. The metabolism of biphenyl by pigs, rabbits, rats and guinea pigs and by liver microsomes of rabbits,

rats and guinea pigs is examined. The metabolism of naphthalenes by laboratory animals and man occurs mainly by glucuronic acid conjugation. PCB binding to rat liver microsomal fractions has been reported and some urinary metabolites have been identified. *In vivo* and *in vitro* studies on the metabolism of organotin compounds have established that microsomally induced *C*-hydroxylation occurs, and the α- and β-hydroxylation products are labile and lead to destannylation products.

80-2284. Burkatskaya, E. N.; Karpenko, V. N.; Pokrovskaya, T. N. (Inst. Vocat. Hyg. & Occup. Dis., Kiev, USSR) **Materialy k toksikologo-gigiencheskoi kharakteristike novogo pestitsida pirimora. [Toxicologic and hygienic evaluation of the new pesticide pyrimor.]** *Gig. Sanit.* 45(4): 8-11; 1980 (12 references) (Russian).

Toxicity of the insecticide pyrimor (2-dimethylamino- 5,6 dimethylpyrimidyl- 4-*N*,*N*-dimethylcarbamate; pirimicarb) was studied in albino mice, rats, cats and rabbits. The LD50 after ig administration was 111 mg/kg for rats and 68 mg/kg for mice. The coefficient of species specificity was 1.6. Clinical manifestations of acute poisoning with pyrimor was similar to those after poisoning with other organophosphorus compounds. The majority of animals died within the first 2 hr of exposure. Pyrimor at 100 mg/kg resulted in a 56-70% decrease of brain cholinesterase activity 10 min after administration. Pyrimor had mild skin-resorption activity; skin application at 900 mg/kg caused death of some rabbits. Single inhalation exposure to pyrimor at 2.6 mg/m^3 did not induce clinical manifestations of poisoning in rats and cats; 18 and 180 mg/m^3 were toxic concentrations. Chronic exposure to pyrimor at 0.56 mg/m^3 decreased activity of brain cholinesterase. The toxic concentration for rats was 3.8 mg/m^3.

80-2285. Al-Gailani, M.; Garrett, J. R.; Kidd, A.; Kyriacou, K.; Leite, P. (Dep. Oral Pathol., Dental Sch., King's Coll. Hosp., London SE5 8RX, England) **Localisation of esteroproteases in resting salivary glands from different species and the effects of the organophosphorus inhibitor E600.** *Histochemistry* 66(1): 59-74; 1980 (21 references).

Two main types of enzyme activity were noted in the parenchyma of resting salivary glands from rats, guinea pigs, cats, dogs and rabbits using *N*-acetyl-L-methionine α-naphthyl ester as substrate. Peri-luminal esteroprotease activity was present and is assumed to arise from secretory enzymes that will pass into the saliva. Enzyme activity was also demonstrated in acinar cells involved in processing secretory products. In rats, cats, and guinea pigs the ductal activity had a relationship with sites of tryptophan staining but this was not the case in rabbits or dogs. The organophosphorus inhibitor E600 (paraoxon) was used in attempts to qualify the enzymes demonstrated. Acinar cell activity was inhibited by E600 in all species. In rabbits and dogs ductal activity was also inhibited. A slight inhibition of ductal activity was noted in cats. No effect was observed in rats and guinea pigs. No effects of E600 on mast cell activity was found.

80-2286. Tilak, K. S.; Rao, D. M. R.; Devi, A. P.; Murty, A. S.* (Dep. Zool., Nagarjuna Univ., Nagarjunanagar 522510, India) **Toxicity of carbaryl & 1-naphthol to the freshwater fish *Labeo rohita*.** *Indian J. Exp. Biol.* 18(1): 75-76; 1980 (13 references).

The toxicities of carbaryl and 1-naphthol were compared on 2 sizes of fish and the latter compound appeared to be more toxic than the former to the freshwater fish *Labeo rohita*. It was noted that with increased size of the fish there was an apparent reduction in the toxicity of both carbaryl and 1-naphthol. In aquatic environments the lethal concentrations of toxicants are expressed on the basis of the quantities present in water and not in the organism. Therefore, it is suggested, the same concentration of toxicant in water will be in contact with a larger body mass and greater absorption, storage and metabolism will occur. For these reasons the apparent toxic effect observed will be lower.

80-2287. Abdel-Aal, Y. A. I.; Helal, T. Y. (Plant Prot. Dep., Coll. Agric., Assiut Univ., Assiut, Egypt) **Relative toxicity and anticholinesterase activity of phosfolan and carbofuran to four rodent species.** *Int. Pest Control* 22(2): 40-41; 1980 (13 references).

Tests were performed on 4 rodent species to determine the relative toxicity of phosfolan and carbofuran. Five to eight dosages of these pesticides were administered orally to the rats and mortalities were recorded after 24 hr. Rat brain cholinesterase assays were also performed by colorimetric methods. The LD50 values for carbofuran were similar, ranging from 11-15 mg/kg. LD50 values ranged from 14-31 mg/kg for phosfolan. The order of most susceptible to most tolerant was Norway rat, grey-bellied rat, white-bellied rat, and the grass rat. The molar concentration of insecticide that caused 50% reduction in cholinesterase activity ranged from 1.16×10^{-6} to 6.95×10^{-6} for carbofuran and 1.0×10^{-4} to 1.6×10^{-4} for phosfolan. It is concluded that the toxicity of these compounds varies among target organisms.

80-2288. Kimmel, E. C.· Casida, J. E.*; Fish, R. H. (Pestic. Chem. & Toxicol. Lab., Dep. Entomol. Sci., Univ. California, Berkeley, CA 94720) **Bioorganotin chemistry. Microsomal monooxygenase and mammalian metabolism of cyclohexyltin compounds including the miticide cyhexatin.** *J. Agric. Food Chem.* 28(1): 117-122; 1980 (9 references).

Metabolism of cyclohexyltriphenyltin by the rat liver microsomal monooxygenase system yields *trans*-2-, *cis*-3-, *trans*-3-, and *trans*-4-hydroxycyclohexyltriphenyltin and the analogous 3- and 4-keto derivatives. The major product is *trans*-4-hydroxycyclohexyltriphenyltin. Cyclohexyldiphenyltin acetate in this microsomal system gives *trans*-2-hydroxycyclohexyldiphenyltin acetate as the principal metabolite plus the 3- and 4-hydroxy compounds. Metabolites of these ^{14}C-labeled substrates were identified by TLC cochromatography with unlabeled standards from synthesis except for *trans*-2-hydroxycyclohexyldiphenyltin acetate which was degraded to cyclohexane for determination as its oxymercuration adduct. Metabolism of tricyclohexyltin hydroxide, the important miticide cyhexatin or Plictran, yields products with the anticipated chromatographic properties for 2-, 3-, and 4-hydroxycyclohexyldicyclohexyltin derivatives. The 2-hydroxy metabolite is readily degraded to cyclohexane and dicyclohexyltin compounds. Chemical ionization mass spectrometry supports the identity of the 3- and 4-hydroxycyclohexyldicyclohexyltin derivatives. Products with chromatographic properties similar to the microsomal metabolites are present in the feces of rats, mice, guinea pigs, and rabbits orally administered [^{14}C] cyhexatin. (Author abstract reprinted by permission of the American Chemical Society)

80-2289. Atallah, Y. H.; Yu, C. C.; Whitacre, D. M. (Res. & Dev. Dep., Velsicol Chem. Corp., Chicago, IL 60611) **Metabolic fate of the herbicide buthidazole in lactating cows and laying hens.** *J. Agric. Food Chem.* 28(2): 278-286; 1980 (2 references).

[^{14}C]Buthidazole {3-[5-(1,1-dimethylethyl) -1,3'4-thiadiazol-2-^{14}C yl]-4-hydroxy-1-methyl-2-imidazolidinone} was administered in twice-daily oral doses for 14 consecutive days to cows at dosages equivalent to 0.5, 2.5, and 10 ppm in the diet and to hens at dosages equivalent to 0.3, 1.5, and 6 ppm in the diet. Within 12 hr of the final [^{14}C]buthidazole dose, 80% of total administered ^{14}C was excreted in cow urine, 8% in feces, and 1% in milk; 82% was eliminated in hen excreta. Residues, as a function of dietary concentration, were about 1.4% for milk, 0.4% for eggs, 2% for cow muscle, and 0.2% for hen muscle. No residue was detected in milk, eggs, or tissues 7 days after treatment ceased. Only 0.1% of the radiocarbon excreted in cow urine was buthidazole. Hen excreta contained < 1% unchanged buthidazole. Twelve metabolites were identified by thin-layer chromatography and mass spectrometry. The degradation pathway included hydroxylation, oxidation, demethylation, dehydration, ring opening, and hydrolysis. The major metabolites were *N*-[5-(1,1-dimethylethyl) - 1,3,4-thiadiazol- 2-]urea, 3-[5-(1,1-dimethylethyl) -1,3,4-thiadiazol- 2-yl]-4- hydroxy-2-imidazolidinone, 3-[5-(1,1-dimethylethyl) 1,3,4-thiadiazol- 2-yl] 4,5-dihydroxy-1-methyl-2-imidazolidinone, 3-[5-(1,1,-dimethylethyl) -1,3,4-thiodiazol- 2-yl] 4,5-dihydroxy-2- imidazolidinone, and *N'*-[5-(1,1-dimethylethyl) -1,3,4-thiadiazol- 2-yl] *N*-hydroxymethyl- *N*-methylurea. (Author abstract reprinted by permission of the American Chemical Society)

80-2290. Sudershan, P.; Khan, M. A. Q. (Dep. Biol. Sci., Univ. Illinois Chicago Circle, Chicago, IL 60680) **Metaboilsm of *cis* (^{14}C)chlordane and *cis* (^{14}C)photochlordan bluegill fish.** *J. Agric. Food Chem.* 28(2): 291-297; 1980 (36 references).

Bluegill fish rapidly absorbed *cis*[^{14}C]chlordane or *cis*[^{14}C]photochlordane during a 48 hr exposure to 5 ppb of each insecticide. Elimination of chlordane was linear but slow during the 6 wk period, while that of photochlordane was biphasic, being rapid in the early phase (first 3 wk). Less than 7% of the radioactivity retained in the chlordane-treated fish was in the form of 2 conjugates, which on acid hydrolysis yielded at least 8 hydroxylated products. In the case of photochlordane, 16% of the radioactivity in fish was in the form of 9 apolar and 5 polar metabolites. Twenty-five percent of the radioactivity excreted in water by photochlordane-treated fish was in the form of 2 metabolites, the remaining being unchanged photochlordane. (Author abstract reprinted by permission of the American Chemical Society)

80-2291. Rhodes, R. C.; Jewell, R. A. (Biochem, Dep., Res. Div., Exp. Stn., E. I. du Pont de Nemours & Co. Inc., Wilmington, DE 19898) **Metabolism of ^{14}C-labeled hexazinone in the rat.** *J. Agric. Food Chem.* 28(2): 303-306; 1980 (5 references).

The active ingredient in Velpar weed killer is 3-cyclohexyl-6-(dimethylamino) -1-methyl-1,3,5-triazine-2,4(1*H*, 3*H*-dione (hexazinone). When a rat was given a single oral dose of radiolabeled hexazinone by intragastric intubation, the radioactivity was eliminated within 72 hr in the urine (61%) and feces (32%). Trace amounts of radioactivity were also found in the gastrointestinal tract (0.06%) and expired air (0.08%). No radioactivity (< 0.01%) was detected in body tissues. The major metabolites in both urine and feces were 3-(4-hydroxycyclohexyl) -6-(dimethylamino) -1-methyl 1,3,5-triazine-2,4 (1*H*,3*H*)-dione and 3-(4-hydroxycyclohexyl)-6-(methylamino)-1-methyl 1,3,5-triazine-2,4 (1*H*,3*H*)-dione. (Author abstract reprinted by permission of the American Chemical Society)

80-2292. Rhodes, R. C. (Biochem. Dep., Res. Div., Exp. Stn., E. I. du Pont de Nemours & Co. Inc., Wilmington, DE 19898) **Studies with ^{14}C labeled hexazinone in water and bluegill sunfish.** *J. Agric. Food Chem.* 28(2): 306-310; 1980 (6 references).

^{14}C residues in bluegill sunfish exposed to water containing [^{14}C]hexazinone at 0.01 and 1.0 ppm for 4 wk

were found to plateau after 1-2 wk of exposure. A maximum accumulation factor of 5-7 was found in the viscera at both exposure levels. Following the 4-wk exposure period, the fish were transferred to fresh water for a 2 wk depuration period. After 1 wk in fresh water the ^{14}C residue levels decreased by greater than 90% and no detectable ^{14}C residues remained in the fish tissue at the end of the 2 wk period. No effects on the fish were noted during the course of the experiment. (Author abstract reprinted by permission of the American Chemical Society)

80-2293. Pasternak, B. S.; Shore, R. E. (Inst. Environ. Med., Med. Cent., New York Univ., New York, NY 10016) **Group sequential methods for cohort and case-control studies.** *J. Chronic. Dis.* 33(6): 365-373; 1980 (21 references).

The group sequential approach was used to analyze data resulting from pre-weaning and post-weaning survival studies of 4 stable laboratory mouse populations, 2 of which were given a continuous dietary level of 100 ppm DDT. Possible effects of DDT were studied over several generations. Use of the group sequential approach on the results of the study demonstrated an overall statistically significant decrease in survival during the pre-weaning tests at the 0.01 probability level after the results from the period covering weeks 26-30 were available for analysis. In post-weaning survival tests an improved survival in the DDT-fed mice was detected at the 0.01 significance level by the group sequential approach at the end of the seventh period. It is suggested that use of the group sequential method can result in substantial reductions in the sample size requirements for case-control as well as cohort-designed studies.

80-2294. Johnson, M. W.; Oatman, E. R.; Wayman, J. A. (Garden City Exp. Stn., Kansas State Univ., Garden City, KS 53706) **Effects of insecticides on populations of the vegetable leafminer and associated parasites on summer pole tomatoes.** *J. Econ. Entomol.* 73(1): 61-66; 1980 (12 references).

Studies were conducted to determine the feasibility of using a biotic larvicide or an ovicide as alternatives to methomyl for control of lepidopterous pests on summer plantings of fresh market tomatoes to avoid upsetting populations of *Liriomyza sativae* Blanchard and its parasites. Significantly higher *L. sativae* densities were recorded in methomyl-treated plots compared to those which occurred in Dipel *(Bacillus thuringiensis)* and chlordimeform treated plots. *Diglyphus begini* (Ashmead) and *Chrysonotomyia (Achrysocharella) punctiventris* (Crawford) were adversely affected by methomyl treatments and the latter parasite also was similarly affected by chlordimeform and Dipel-chlordimeform treatments. Significantly higher fruit yields were recorded from methomyl-treated plots as compared to yields from Dipel- and chlorpyrifos-treated plots and from an untreated check, although leafminer densities were significantly higher in the methomyl treatment. A pupal survey technique was more sensitive to differences between treatments than leaflet sampling. (Author abstract by permission)

80-2295. Johnson, M. W.; Oatman, E. R.; Wyman, J. A. (Garden City Exp. Stn., Kansas State Univ., Garden City, KS 67846) **Effects of insecticides on populations of the vegetable leafminer and associated parasites on fall pole tomatoes.** *J. Econ. Entomol.* 73(1): 67-71; 1980 (4 references).

Several insecticides that control lepidopterous pests were evaluated for their effects on populations of *Liriomyza sativae* Blanchard and associated parasites in fall plantings of fresh market tomatoes in southern California. All rates of methomyl tested caused increases in *L. sativae* densities and reduced populations of 2 of its principal larval parasites, *Diglyphus begini* (Ashmead) and *Chrysonotomyia (Achrysocharella) punctiventris* (Crawford). Chlorpyrifos gave excellent control of the leafminer, but decimated its parasite populations. Parasitization of *L. sativae* by the larval-pupal parasite, *Chrysocharis parski* Crawford, was reduced *ca.* 40% in plots treated with methomyl at 0.5 kg AI/ha. Dipel *(Bacillus thuringiensis)* did not adversely affect either the vegetable leafminer or its parasites. No significant tomato fruit yield reductions occurred in methomyl-treated plants, although they had significantly more *L. sativae* mines than untreated plants. (Author abstract by permission)

80-2296. El-Sabae, A. H.; Othman, M. A. S.; Hammam, S. M.; Tantawy, G.; Soliman, S. A. (Pestic. Div., Plant Prot. Dep., Fac. Agric., Alexandria Univ., Alexandria, Egypt) **Delayed neurotoxicity of cyanofenphos in chickens.** *J. Environ. Sci. Health B* 15(3): 267-285; 1980 (26 references).

Cyanofenphos was given to Alexandria strain laying hens in single po doses of 8, 12, 16, 40, 80, 160, 240, and 540 mg/kg. In a second series of experiments, Nucles chickens were given repeated daily oral doses of either 1.5 or 3 mg/bird/day. During the single dose study, doses of 8, 12, 16, and 40 mg/kg caused no severe symptoms or deaths within wk 1. Abnormal clinical signs were minimal. Simple weakness of the legs was noted in those having no more than 16 mg/kg dose levels, which improved at 13-24 days. Ataxia developed at dose levels between 80 and 540 mg/kg and was followed by paralysis 10 to 24 days after treatment. Axonal and myelin degeneration affected the long tracts in spinal cord, peripheral nerves and medulla. In the repeated oral dosing study, 11 of 30 hens at the 1.5 mg/bird/day level developed ataxia by day 16 of treatment. At the higher dose level 19 of 30 were paralyzed at day 16.

80-2297. Hood, R. D.; Patterson, B. L.; Thacker, G. T.; Sloan, G. L.; Szczech, G. M. (Dep. Biol., Univ. Alabama, Tuscaloosa, AL) **Prenatal effects of 2,4,5-T, 2,4,5-trichlorophenol, and phenoxyacetic acid in mice.** *J. Environ. Sci. Health C* 13(3): 189-204; 1979 (17 references).

A 1:1 solution of honey: water containing 2,4,5-T, phenoxyacetic acid and 2,4,5-trichlorophenol was administered to pregnant mice by gavage once/day for days 8 through 15 of gestation. Other mice received the chemicals on three consecutive days: days 7-9, 10-12, or 13-15 of gestation. Dose levels were 800-900 mg/kg for the single dose study, and 250-300 mg/kg for the multiple treatments. Only 2,4,5-T significantly increased prenatal mortality and only 2,4,5-T was associated with decreased fetal weight. 2,4,5-T also caused significantly increased numbers of cleft palate or other gross malformations to occur. It is suggested that both the carboxyl group and chlorination of the aromatic ring are essential for the unambiguous teratogenic response.

80-2298. Montgomery, M. R.; Niewoehner, D. E. (Pulm. Toxicol. Lab., Vet. Adm. Hosp., Minneapolis, MN 55417) **Oxidant induced alterations in pulmonary microsomal mixed function oxidation acute effects of paraquat and ozone.** *J. Environ. Sci. Health C* 13(3): 205-219; 1979 (32 references).

Male Charles River CD rats were given ip injections of paraquat (20 mg/kg) or were exposed to ozone (1 ppm) over 24 hr. Pulmonary microsomal pellets were then prepared and cytochrome P450-mediated benzphetamine *N*-demethylase activity, fatty acid desaturation, and lipid peroxidation were determined. Paraquat did not produce an effect on the mixed function oxidase (MFO) activity until 4 days after treatment, but the effect was still present 2 wk later. Ozone caused immediate inhibition of pulmonary mixed function oxidations. Paraquat treatment did not affect cytochrome b_5-mediated lipid peroxidation whereas ozone treatment stimulated this activity. These were resolved by 1 wk after exposure. Microsomal lipid peroxidation was not sufficient to explain these alterations in MFO activity. Nor did the cytochrome P450 and b_5 concentrations accurately reflect the observed changes in the enzymatic activities. The sites of paraquat and ozone mediated MFO alterations are not known.

80-2299. Rao, K. S.; Dad, N. K. (Sch. Stud. Zool., Vikram Univ., Ujjain 456010, India) **Studies of herbicide toxicity in some freshwater fishes and ectoprocta.** *J. Fish Biol.* 14(6): 517-522; 1979 (25 references).

The effects of the herbicides Aresin (monolinuron), Tafazine (simazine), dalapon, Planavin (nitralin), Bladex (cyanazine) and 2,4-D butyl ester on 3 species of Ectoprocta and 5 fishes were investigated. *Sarotherodon mossambicus* was highly susceptible to Tafazine toxicity. *Danio* sp. was less susceptible to Tafazine, while *Puntius tito* was the most tolerant of this herbicide. *S. mossambicus* was more resistant to Bladex than was *Cirrhinus mrigala. Channa punctatus* showed resistance to Aresin toxicity. Mixtures of Planavin + mercuric chloride and Planavin + Bladex were also tried on freshwater ectoproct invertebrates. Leptoblasts of *Plumatella casmiana* and spinoblasts of *Lophopodella carteri* were effected by herbicide toxicity.

80-2300. Dutton, M. F.; Anderson, M. S. (Dep. Life Sci., Trent Polytech., Nottingham NG1 4BU, England) **Inhibition of aflatoxin biosynthesis by organophosphorus compounds.** *J. Food Prot.* 43(5): 381-384; 1980 (14 references).

Chlormephos, Ciodrin (crotoxyphos), naled, Phosdrin (mevinphos), and trichlorfon at concentrations of 20 or 100 μg/ml culture fluid lowered aflatoxin levels produced by *Aspergillus flavus.* The formation of several anthraquinone pigments was also noted. Versicol was one of these pigments, and appears not to have been noted previously. Another new pigment appeared to be the acetate derivative of Versicol. Ammonium nitrate and tridecanone also elicited a dichlorvos-type activity. It is suggested that tridecanone or its breakdown products competitively inhibit enzymes which are involved in aflatoxin biosynthesis. Such inhibition might explain the lowered aflatoxin production in lipid-rich commodities infected by *A. flavus.*

80-2301. Zettler, J. L. (Stored-Product Insects Res. & Dev. Lab., Agric. Res., SEA, USDA, Savannah, GA 31403) **Synthetic juvenile hormone analog, a synergist of pyrethrins toxicity to malathion-susceptible and malathion-resistant *Tribolium castaneum* (Herbst).** *J. Ga. Entomol. Soc.* 14(3): 187-189; 1979 (10 references).

GP-3 malathion-resistant and susceptible red flour beetles (*Tribolium castaneum*) were treated topically with acetone solutions of pyrethrins containing either piperonyl butoxide or Hoffman-La Roche RO 20-3600, a juvenile hormone analog (JHA), at a ratio of 1:10. RO 20-3600 showed greater synergistic action than did piperonyl butoxide in both strains. Synergism was greater when pyrethrins were used against the susceptible strain, but both strains were reduced to approximately the same level of susceptibility to pyrethrins by the JHA. When the LD50 values of the synergists were compared, the malathion-resistant insects were more susceptible to the pyrethrins + piperonyl butoxide than were the susceptible insects. These findings were in agreement with earlier toxicity tests on the GP-3 strain which showed that these insects possess no cross-resistance to other insecticides, including a synthetic pyrethroid.

80-2302. Graham, D. G.; Lee, J. S.; Ahmed, M. S.; Cook, L.; Abou-Donia, M. B. (Duke Univ., Durham, NC) ***In vivo* and *in vitro* degeneration of the sympathetic nervous system in organophosphorus-induced delayed neurotoxicity.** *J. Neuropathol. Exp. Neurol.* 39(3): 356; 1980.

Studies are described in which hens were given single doses of leptophos and tri-*o*-cresyl phosphate (TOCP). The treatments produced ataxia progressing to paralysis by the time of sacrifice at 14 days. Myelinated axons in peripheral nerves and in the long ascending and descending tracts in the spinal cord were found to be degenerated. The sympathetic nervous system was also found to be vulnerable, as evidenced by significant reductions in the cocaine-inhibitable uptake of (^{3}H)norepinephrine by 1 mm slices of cardiac atria. Two human adrenergic neuroblastoma cell lines were found to exhibit the same order of reductions in cocaine-inhibitable (^{3}H)norepinephrine uptake after exposure to agar-adsorbed organophosphorus agents (merphos, DEF, EPN, parathion, TOCP and leptophos). This is suggested to be a potential sensitive screening procedure for the capacity of a given organophosphorus insecticide to induce delayed neurotoxicity. It is also suggested that delayed neurotoxicity may be a property of all organophosphorus agents. [Abstracts of the 56th Annual Meeting of the American Association of Neuropathologists; abstract 57]

80-2303. Bernard, A.; Carlier, H. (Lab. Physiol. Nutr., Ec. Natl. Super. Biol. Appl. Nutr. & Aliment., Univ. Dijon, F-21100 Dijon, France) **Action d'un inhibiteur de la synthese proteique, l'actidione-cycloheximide, sul l'ultrastructure de l'enterocyte de Rat a jeun. [Effect of an inhibitor of protein synthesis, acidione-cycloheximide, on enterocyte ultrastructure of fasting rat.]** *J. Physiol. (Paris)* 76(1): 71-77; 1980 (34 references) (French).

Actidione-cycloheximide (cycloheximide; 1.6 mg/kg, ip) was given to fasting rats. Cytotoxic effects were noted on absorptive cells 4-10 hr after injection. A reduction was noted in both the number and size of microvilli. Characteristics of the terminal web disappeared. A disorganization of the endoplasmic reticulum was noted, with a lack of ribosomes on saccules. Ribosomes were scattered and sometimes aggregated in the endoplasmic reticulum membranes. The rough endoplasmic reticulum saccules surrounding mitochondria were not present. Mitochondria demonstrating a normal appearance were seen to frequently possess myelin images or membrane whorls. The turn-over of the Golgi complex membranes was affected and the apparatus demonstrated a greatly reduced number of saccule sacks. Few endocytosis images were present in the enterocyte. Membrane whorls and autophagic vacuoles were found in the supranuclear cytoplasm.

80-2304. Ramsdale, C. D.; Herath, P. R. J.; Davidson, G. (Varndean Lodge, Brighton, Sussex, England) **Recent developments of insecticide resistance in some Turkish anophelines.** *J. Trop. Med. Hyg.* 83(1): 11-19; 1980 (8 references).

A study of insecticide resistance in mosquitos is presented. Field and laboratory studies were performed on several strains of anophelines from Turkey. The mosquitos were exposed to 5 pesticides. Adult survivors were mated and their eggs and larvae were then tested. The effect of temperature on the toxicity of the pesticides was also determined. Results show significant survivorship rates of *Anopheles sacharovi* when exposed to fenthion, fenitrothion, and propoxur. Survivorship was higher the following year. Larval tests performed in conjunction with these field tests confirmed these findings and gave additional evidence for resistance to chlorpyrifos and malathion. Temperature was shown to be positively correlated with mortality due to pesticides. The nature of resistance is discussed.

80-2305. Anonymous **[Outline of a pyrethroid insecticide, Paracide emulsive concentrate.]** *Jui Kai (Vet. World)* (117): 27-37; 1980 (Japanese).

A review of Paracide e.c. (active ingredient: chryson-forte, a pyrethroid insecticide) is presented. The inhalation LC50 of Paracide to rats is 45,930 mg/m^3 and the acute oral LD50s to female and male rats and female and male mice are 4.22, 6.20, 3.25 and 3.25 ml/kg body wt, respectively. No significant effects were observed in cows, pigs or poultry sprayed once a week for 4 wk with a 100-fold diluted solution of Paracide. Lactating cows were sprayed for 3 days with a 100-fold diluted solution at 250 mg/cow/day and no residues of chryson-forte were observed in the milk at 3 hr after spray. In purifying tanks at concentration greater than 500 ppm, chryson-forte does not degrade rapidly.

80-2306. Jensen, S. (Stralningsbiol. Inst., Wallenberg Lab., Stockholm Univ., Stockholm, Sweden) **Toxafen. Nytt globalt miljohot. [Toxaphene: a new global environmental hazard.]** *Kem. Tidskr.* 92(5): 38-41; 1980 (2 references) (Swedish).

The general ecological and toxicological aspects of toxaphene are discussed. Toxaphene has never been used in Sweden, but toxaphene levels of 0.4-9 ppm were found in fish caught in a lake in Sweden and in the Baltic sea off the Swedish coast. The LD50 determined for fish in a 96-hr test is 0.5-14 $\times 10^{-3}$ μg/kg. The LD50 in various experimental mammals is 13-3000 mg/kg. Cumulation factors of up to 70,000 were found in fish. Under anaerobic conditions, the half-life of toxaphene in soil is about 6 wk, but can be as long as 10 yr under aerobic conditions. Toxaphene is highly stable in water. Orally administered toxaphene induced hepatocellular carcinoma in 98% of male mice and in 69% of female mice. Toxaphene was found to be mutagenic in Ames test with *Salmonella* with and without activation of hepatic enzymes.

80-2307. Zakharov, B. A.; Nen'ko, N. I.; Badovskaya, L. A.; Dubonosov, T. S.; Nebroeva, I. G.; Latashko, V. M.; Kul'nevich, V. G.; Ignatukhin, V. G. (Krasnodar Polytechnical Inst., Krasnodar, USSR) **Primeninie krotonolaktona dlya povysheniya urozhainosti kukuruzy i ozimoi pshenitsy v krasiodarskom krae. [Use of Crotonlacetone for increased yield of corn and winter wheat in Krasnodar Krai.]** *Khim. Sel'sk. Khoz.* 18(3): 43-45; 1980 (14 references) (Russian).

The results of extensive trials on plant growth stimulators from the group of unsaturated five-membered lactones are reported. Chemically pure Crotonlactone ((5*H*)-furanon-2) and its mixture with acids (raw Crotonlactone) were used. (5*H*)-Furanon-2 was found to be a mildly toxic compound; the LD50 for albino mice and rats was 560 and 478 mg/kg, respectively. Treatment with both pure and raw Crotonlactone (0.05-0.1 mg/kg) increased the germination force and rate of corn and winter wheat seeds and increased the yield of these crops.

80-2308. Weis, J. S.; Weis, P. (Dep. Zool. & Physiol., Rutgers State Univ. New Jersey, Newark, NJ) **Effects of mercury, cadmium and lead compounds on regeneration in estuarine fishes and crabs.** In: *Marine Pollution: Functional Responses.* Verhberg, W. B., et al., eds. (Academic Press: NY): pp. 151-169; 1979 (53 references).

Recent work on the effects of Hg, Cd and Pb on regeneration in estuarine fishes and crabs is presented. The lower portion of each caudal fin of killifish or mullets was amputated. The fish were placed in seawater containing lead nitrate, anhydrous cadmium chloride, or mercuric chloride at 0.01, 0.1 or 1.0 mg/l, or methylmercuric chloride at 0.001 or 0.01 mg/l. Regenerates were measured twice weekly. Mercuric chloride caused severe mortality, but regeneration was comparable to controls. Lead had no effect on regeneration and was not toxic at the levels used. Cadmium greatly retarded wound healing and blastema formation, but once healing had occurred and delayed regeneration had commenced, it proceeded at a rate comparable to controls. Regeneration was retarded by methylmercuric chloride, but the effect was insignificant when the salinity of the water was reduced or when $CdCl_2$ was also present. Limb regeneration was studied in the fiddler crab, *Uca pugilator*, and it was determined that $CdCl_2$ at 0.1 and 1.0 mg/l, $HgCl_2$ at 1.0 mg/l and methylmercury at 0.5 mg/l inhibited regeneration. It is noted that the prolongation of regeneration caused by heavy metal pollutants makes the animal more subject to predation and serves as a means of passing on more of the toxicant to higher levels in the food chain.

80-2309. Cunningham, P. A. (Dep. Biol., North Carolina Cent. Univ., Durham, NC) **The use of bivalve molluscs in heavy metal pollution research.** In: *Marine Pollution: Functional Responses.* Vernberg, W. B., et al., eds. (Academic Press: NY): pp. 183-221; 1979 (103 references).

A review of the use of bivalve molluscs in heavy metal research is presented. A summary of research on the effects of heavy metals on marine and estuarine bivalves, a discussion of factors important in the design of experiments using bivalves and identification of areas for future research are included. Studies carried out using the various stages (embryos, larvae, spat and juveniles, and adults) are summarized. It is suggested that each succeeding stage in development toward adulthood is increasingly more resistant to higher environmental metal concentrations. *Crassostrea virginica* and *Mercenaria mercenaria* embryos were found to be sensitive to metals in the order Hg > Ag > Zn > Ni > Pb. In studies on *C. virginica* larvae, LC50 concentrations of $HgCl_2$ (0.012 ppm Hg), $AgNO_3$ (0.025 ppm Ag), $CuCl_2$ (0.033 ppm Cu) and $NiCl_2$ (1.2 ppm Ni) retarded shell growth to 49, 67, 68 and 45% of control growth, respectively. In experiments on adult mussels, methyl mercury acetate decreased feeding rates, and Cu produced significant cardiovascular and respiratory depression. Effects of intrinsic factors (age, size, weight, reproductive condition, sex and heavy metal body burden attained) and extrinsic factors (temperature, salinity, chemical form, heavy metal interactions, concentration and duration of exposure) on uptake and accumulation of heavy metals are discussed. Pathways for accumulation, storage, and loss of heavy metals are also described. Studies on heavy metal distribution in muscle, byssal gland, kidney, gonad, mantle, gills and digestive system are summarized, along with studies on the intracellular activity of metals.

80-2310. Bodammer, J. (NOAA, Northeast Fish. Center., Oxford Lab., Natl. Marine Fish. Serv., Oxford, MD) **Preliminary observations on the cytopathological effects of copper sulfate on the chemoreceptors of *Callinectes sapidus*.** In: *Marine Pollution: Functional Responses.* Vernberg, W. B., et al., eds. (Academic Press: NY): pp. 223-237; 1979 (24 references).

Adult male blue crabs *(Callinectes sapidus)* were used in studies to determine effects of copper on crustacean chemoreceptors. Animals were exposed for 48 hr to river water containing hydrated copper sulfate reagent ($CuSO_4 \cdot 5H_2O$) at concentrations of 0, 50, 100 and 1000 μg/l. The left chemoreceptor antennule was removed prior to exposure and used as a control tissue, and the right chemoreceptor antennule was removed after exposure. The antennules were examined by transmission electron microscopy. Exposure to 1000 μg/l $CuSO_4$ caused chages affecting both the integrity and disposition of the dendrites within the aesthetases. Changes included condensation of the dendrites and flocculent extracellular material into a bandlike region, consistent loss of the large dendrite profiles, and the occurrence of electron dense filamentous structures not present in control preparations. Changes in chemoreceptor structures following 100 μg/l $CuSO_4$ were

similar to those with 1000 μg/l, but less pronounced. Exposure to 50 μg/l $CuSO_4$ had little noticeable effect on the morphology of blue crab chemoreceptors.

80-2311. Garnas, R. L.; Crosby, D. G. (Environ. Res. Lab., US EPA, Gulf Breeze, FL 32561) **Comparative metabolism of parathion by intertidal invertebrates.** In: *Marine Pollution: Functional Responses.* Vernberg, W. B., et al., eds. (Academic Press: NY): pp. 291-305; 1979 (29 references).

The comparative metabolism of parathion by marine intertidal invertebrates was examined. Animals used were the sea star, California mussel, black turban snail, and sea anemone (chosen as a representative cross-section of marine invertebrate phylogeny). One μCi (157μg) of 2,6-ring labeled parathion was added to the chamber, and the system was operated for 96 hr. Water was analyzed using a liquid scintillation spectrometer. Radioactivity was also determined in the test animals at the end of each experiment. Parathion and metabolites were removed by XAD-4 resin, which was analyzed by TLC and autoradiography. Mussels showed the most rapid rate of radioactive parathion uptake. The 2 species of sea anemone had similar rates of uptake. The sea star and snails displayed vigorous metabolism of parathion to paraoxon (PO) and *p*-nitrophenol (PNP). The 2 species of sea anemone metabolized only a small amount of parent compound to PO and PNP. The mussels were capable of only minimal hydrolysis of parathion to PNP. It is concluded that the metabolism of parathion by the invertebrates studied involved typical metabolic pathways of oxidation, reduction and hydrolysis. However, these invertebrates do not metabolize parathion to the same extent or display the diversity of metabolic pathways characteristic of terrestrial animal studies.

80-2312. Rao, K. R.; Fox, F. R.; Conklin, P. J.; Cantelmo, A. C.; Brannon, A. C. (Fac. Biol., Univ. West Florida, Pensacola, FL) **Physiological and biochemical investigations of the toxicity of pentachlorophenol to crustaceans.** In: *Marine Pollution: Functional Responses.* Vernberg, W. B., et al., eds. (Academic Press: NY): pp. 307-339; 1979 (66 references).

A series of physiological and biochemical investigations to determine the effects of pentachlorophenol (PCP) and its water soluble salt, sodium pentachlorophenate (Na-PCP) on crustaceans are presented. Various long- and short-term experiments were carried out using grass shrimp and blue crabs. Newly molted shrimp exhibited the greatest sensitivity to Na-PCP in both short-term (96 hr bioassay) and long-term (66 day) studies. Limb regeneration in the grass shrimp was inhibited in a dose dependent fashion by Na-PCP exposure. The early phase of regeneration was most sensitive. Studies on blue crabs showed that Na-PCP and 2,4-dinitrophenol (DNP) had inhibitory effects on several hepatopancreatic enzymes (fumarase, succinate dehydrogenase, malate dehydrogenase, glucose-6-phosphate dehydrogenase, pyruvate kinase, lactate dehydrogenase, glutamate-pyruvate transaminase and a microsomal calcium-activated ATPase). The results indicate that PCP affects carbohydrate metabolism, lipid metabolism, ion transport and possibly protein metabolism. It is suggested that the broad-spectrum biocidal effects of PCP and its salts may be due to its overall inhibitory effects on a variety of enzymes.

80-2313. Rubenstein, N. I. (Fac. Biol., Univ. West Florida, Pensacola, FL) **A benthic bioassay using time-lapse photography to measure the effect of toxicants on the feeding behavior of lugworms.** In: *Marine Pollution: Functional Responses.* Vernberg, W. B., et al., eds. (Academic Press: NY): pp. 344-350; 1979 (15 references).

The effects of Kepone (chlordecone) on the feeding behavior of lugworms was measured with the use of time-lapse photography. Bioassays were performed by mounting motor driven 35 mm cameras above two 125 *l* aquaria containing lugworms. One aquaria was used as a control and Kepone was added to the other. During the course of the study the tunnels made during feeding were observed. Experimental tanks received 2.8, 6.6 and 29.5 μg Kepone/l. All levels of the pesticide reduced feeding behavior. It is suggested that sublethal responses to pollutants provide sensitive means of evaluating the impact of pollutants on benthic organisms.

80-2314. Costlow, J. D. (Mar. Lab., Duke Univ., Beaufort, NC) **Effect of Dimilin on development of larvae of the stone crab *Menippe mercenaria*, and the blue crab, *Callinectes sapidus*.** In: *Marine Pollution: Functional Responses.* Vernberg, W. B., et al., eds. (Academic Press: NY): pp. 355-363; 1979 (18 references).

Studies were performed to determine the effects of the insect growth regulator Dimilin (diflubenzuron) on larval development of 2 species of crabs. The larvae of the stone crab and blue crab were exposed to varying salinities, pesticide concentrations and temperatures. Salinities ranged from 20 to 35 ppt for stone crab studies, with pesticide concentrations of 0.5-6.0 ppb at 25°C. Blue crab studies were conducted at salinities of 20-30 ppt, pesticide concentrations of 0.1-6.0 ppb and temperatures of 20-30°C. All concentrations of Dimilin were lethal to stone crab larvae. Survival for the blue crabs varied greatly. At 20°C, 20 ppt and 30 ppt Dimilin concentrations of 1 ppb or less resulted in survival similar to controls. Concentrations of 3-6 ppb resulted in either zero or < 5% survival. The 30°C at 20 ppt salinity test resulted in zero survival at 3.0 and 6.0 ppb; at lower concentrations survival was equal to controls. At 30°C total mortality occurred at 0.5-1.0 ppb, regardless of salinity.

80-2315. Dimitrijevic, J. (Inst. Pathol. Forensic Med., VMA, Belgrade, Yugoslavia) **Prikaz slucaja trovanja herbicidom nomosanom. [A case of poisoning with the herbicide Monosan.]** *Med. Pregl.* 32(7-8): 359-361; 1979 (3 references) (Serbo-Croatian).

An inebriated 60-yr-old man drank Monosan (a herbicidal preparation containing 45% dichlorophenoxyacetic acid; 2,4-D). He was hospitalized in poor condition 37 hr after poisoning. The clinical examinations suggested Monosan poisoning. Toxic hepatitis, toxic nephritis and acute renal insufficiency were found. The patient developed oliguria, arrhythmia with predominance of bradycardia, and died of cardiorespiratory insufficiency. Autopsy revealed bronchopneumonia, perivascular hemorrhage and infiltration in the brain, hypertrophy of the myocardium with parenchymatous degeneration of the muscle fibers, and fatty and parenchymatous degeneration of the liver. 2,4-D levels found (μg/20 g tissue) were 960 in the brain, 808 in the lungs, 135 in the heart, 1180 in the liver, 1386 in the kidneys, 1840 in the gastric contents, 1050 in the intestines (together with the intestinal contents), and 620 μg/10 μg in the blood.

80-2316. Zak, P. I. R.; Ergashev, T. S. (Res. Inst. Obstet. & Gynecol., Moscow, USSR) **Vliyanie pestitsida butifosa na zhenskie gonady v eksperimente. [Experimental study of the effect of pesticide Butifos on female gonads.]** *Med. Zh. Uzb.* (2): 48-50; 1980 (9 references) (Russian).

The effect of the pesticide Butifos (DEF) on the structure and function of the ovaries was studied in rats. Animals were divided into 4 groups. Animals in groups 1, 2 and 3 were subjected to a daily ig administration of an oil-base solution of Butifos at 19.0, 9.0 and 4.5 mg/kg (total doses 216, 108 and 54 mg/kg, respectively). Rats in group 4 served as the control. The experiment lasted for 2 mo. Within different periods of the estrus cycle animals were sacrificed and the ovaries were examined histologically. Butifos at 18.0 mg/kg/day (0.1 LD50) caused a marked decrease of the size of ovaries and uterus. Atrophic changes and vascularization of endometrial glands, lymphocytic histiocytic infiltration in the muscle wall of the uterus, and multiple cystic follicles in the ovaries recorded in rats from group 1 were indicative of the gonado-toxic effect of Butifos at 0.1 LD50. There was no morphological or histological changes in ovaries or uteri of rats from groups 2 and 3.

80-2317. Dunphy, J.; Kesselbrenner, M.; Stevens, A.; Vlec, B.; Jackson, R. J. (San Francisco Gen. Hosp., San Francisco, CA) **Pesticide poisoning in an infant - California.** *Morbid. & Mortal. Wkly. Rep.* 29(33): 254-255; 1980.

A case of an 11-day-old male infant suffering from exposure to chlorpyrifos (Dursban) is reported. The infant was exposed to the chemical in the home over a period of less than 8 days. The home had been sprayed for treatment against termites and roaches. Traces of chlorpyrifos were found on dish towels, food preparation surfaces and in the infant's clothing (suggested to have been contaminanted when laid on shelves which had been sprayed). Use of this chemical on food preparation surfaces is illegal and the County Health Department of San Francisco was notified of the poisoning. It is noted that one of the suggested diagnoses early in the case was that of averted sudden infant death syndrome; the symptoms mimiced this syndrome closely.

80-2318. Stone, W. B. (Author address not given) **Poisoning of wild birds by organophosphate and carbamate pesticides.** *N Y Fish Game J.* 26(1): 37-47; 1979 (7 references).

Eight cases that have been investigated by the Department of Environmental Conservation of New York State and have involved large kills of wild birds by cholinesterase inhibitor pesticides are presented. Ducks exposed to diazinon on an estate lawn exhibited ataxia and spasms before death. Diazinon and chlorpyrifos applied to a golf course were responsible for the death of 8 Canadian geese. Necropsies of these birds showed accumulation of the organophosphates in the gizzard and the liver. In other cases diazinon and Dasanit (fensulfothion) caused death of Canadian geese when used on golf course greens. Carbofuran contamination was seen as the cause of bird kills at an industrial lagoon. Wheat contaminated by carbofuran was intentionally left on a field by a farmer to kill seed-eating birds. Another farmer left parathion-contaminated corn on a field to control birds. A woman who hated birds reportedly sprayed nests and trees with a diazinon solution which resulted in the death of a variety of species. It is suggested that these cases represent the danger to wild birds involved with the use and misuse of organophosphorus and carbamate pesticides.

80-2319. Du Toit, G. D. G. (Ruakura Soil & Plant Res. Stn., Hamilton, New Zealand) **How insecticides work.** *N. Z. J. Agric.* 140(3): 37-39; 1980.

Most insecticides function in a chemical manner to control insect pests. This means they usually react specifically with a body component. The reaction may involve the insecticide and certain vital chemicals in the insect, or in other cases it may cause a weaker type of bonding to occur, and in still other cases the chemical may cause changes in the electrical properties of a nerve. Action sites include the sensory organs, axons, synapses, the neuromuscular junction or the neurosecretory system. Some insect populations develop resistance to specific insecticides, usually through inheritance. Resistance occurs in three ways; by delayed entry of the chemical into the body; by increased breakdown of the toxin by body

metabolism; or by decreased sensitivity of the site in the body where the insecticide operates.

80-2320. Kakiki, K.; Misato, T. (Inst. Physical & Chem. Res., Wako, Saitama 351, Japan) **Effect of isoprothiolane on fatty acid synthesis.** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 4(3): 305-313; 1979 (5 references).

The fungicide isoprothiolane (Fuji-One; 50 μg/ml) inhibited the incorporation of ^{14}C labeled acetate into fatty acids and triglycerides and the incorporation of methionine into phospholipids of *Pyricularia oryzae*. Incorporation of fatty acid into triglycerides and phospholipids was not affected. It is suggested that the inhibition of triglyceride and phospholipid syntheses may be due to the inhibition of fatty acid synthesis by isoprothiolane. An accumulation of lanosterol in treated mycelia was noted at a concentration of 50 μg/ml, but ergosterol synthesis was not changed. Thus this accumulation might be caused by the inhibition of fatty acid synthesis via acetyl-CoA, a precursor of both sterol synthesis and fatty acid synthesis.

80-2321. Inoue, K. (Akitsu Branch, Fruit Tree Res. Stn., Akitsu, Hiroshima 727-24, Japan) **The change of susceptibility of mite populations to dicofol and genetic analysis of dicofol-resistance in the citrus red mite, *Panonychus citri* (MCG).** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 4(3): 337-344; 1979 (29 references).

Two populations of mite were collected in 1971. One was selected with dicofol and the other was reared without selection. The dicofol susceptibility of eggs in the selected populations decreased considerably, but the pattern of decrease was complex. The susceptibility of eggs in the unselected populations increased after 13 or 23 mo. A cross was made between a dicofol-resistant strain and a susceptible strain. No significant differences were noted in susceptibilities of reciprocal crosses, but the susceptibility of hybrid adult females were fairly high compared to the average level of both resistant and susceptible parental strains. It is suggested that resistance to dicofol is a recessive character.

80-2322. Guddewar, M. B.; Dauterman, W. C. (Toxicol. Program. Dep. Entomol., North Carolina State Univ., Raleigh, NC 27650) **Studies on glutathione *S*-transferase preparation from mouse liver which conjugates chloro-*s*-triazine herbicides.** *Pestic. Biochem. Physiol.* 12(1): 1-9; 1979 (26 references).

A glutathione *S*-transferase preparation from mouse liver was purified 61-fold using atrazine as the substrate. The molecular weight of the enzyme preparation was 47,000 and it was a dimer composed of 2 equal subunits having molecular weights of 23,000. The activation energy was 7.76 kcal/mol. The optimum pH range for activity was 8.5 to 9.0. A chloro group at the 2-position was necessary for conjugation to occur. When this 2-chloro was replaced by a methylmercapto group no conjugation occurred. The reaction rate decreased with analogs lacking the alkyl side chains. When experiments measuring the conjugation rate with atrazine, simazine or propazine were undertaken, atrazine was conjugated faster than either of the other two compounds.

80-2323. Sanyal, S.; Agarwal, N.; Sheorain, V. S.; Khuller, G. K.; Chakravarti, R. N.; Subrahmanyam, D.* (Dep. Biochem. & Exp. Med., Postgrad. Inst. Med. Educ. & Res., Chandigarh 160012, India) **Effect of single oral dose of DDT on the lipid metabolism of rhesus monkey.** *Pestic. Biochem. Physiol.* 12(1): 31-37; 1979 (24 references).

DDT (150 mg/kg) was administered via stomach tube to 4 male rhesus monkeys. The animals were sacrificed 48 hr later. A significant increase was noted in plasma triglyceride, esterified cholesterol, and FFA levels of the experimental monkeys. A decrease was noted in total phospholipids and free cholesterol levels. Lipid patterns of kidney and lung did not show significant changes. Adipose tissue demonstrated an elevated triglyceride and FFA count. A decrease in triglycerides but an increase in FFA was recorded in the heart. The post-heparin plasma lipolytic activity increased significantly in the DDT-treated animals. This was due to both protamine-sensitive and resistant fractions. The lecithin-cholesterol acyltransferase activity was increased over two-fold. It was concluded that the DDT-induced hyper-triglyceridemia appeared mainly to be due to the reduced removal rate of circulating triglycerides and an increased triglyceride secretion from the liver.

80-2324. Mallipudi, N. M.; Fukuto, T. R. (Div. Toxicol. & Physiol., Dep. Entomol., Univ. California, Riverside, CA 92521) **Penetration and metabolism of 2-isopropoxyphenyl *N*-methyl-*N*-(2- methyl-4-tert-butylphenyl sulfenyl) carbamate in the housefly and honeybee.** *Pestic. Biochem. Physiol.* 12(1): 55-67; 1979 (17 references).

Houseflies and honeybees were treated with an aryl-sulfenyl derivative of propoxur, 2-isopropoxyphenyl *N*-methyl-*N*-(2- methyl-4-*tert*- butylphenyl sulfenyl) carbamate (I) at a concentration of 24.5 μg/g. The honeybees exhibited no signs of intoxication after treatment. Houseflies demonstrated significant evidence of toxic effects at 12 hr after treatment, with approximately 20% of the flies dead and 60% on their backs with active leg and wing movement. At 300 μg/g a probit mortality line for I with honeybees predicts a 20-25% mortality. Reduced penetration was seen to be a factor in the lack of effect of this compound on the honeybees. Larger amounts of propoxur were found in the housefly than in the honeybee soon after treatment. This slower rate of conversion of I to

propoxur in the bees was also seen as a significant factor in the safety of this compound for use near bees.

80-2325. Brown, T. M.; Hooper, G. H. S. (Pestic. Res. Cent., Michigan State Univ., East Lansing, MI 48824) **Metabolic detoxication as a mechanism of methoprene resistance in *Culex pipiens pipiens*.** *Pestic. Biochem. Physiol.* 12(1): 79-86; 1979 (16 references).

Both susceptible and methoprene-resistant larvae of *Culex pipiens pipiens* were exposed to methoprene. Initially there was no difference between the two populations with regard to uptake of methoprene; 57% in each case. However, the resistant larvae absorbed less of the labeled chemical, and contained 18% less methoprene than the susceptible larvae. In later generations of resistant larvae only 32% of the total absorbed was in the form of methoprene, compared to 43% in the susceptible strain. In both strains the most important metabolites were polar conjugates. The resistant strain produced 40% more total polar conjugates than did susceptible larvae. Oxidase activity in the resistant strains was attributed to the increased detoxification of the growth regulator. Neither strain degraded methoprene *in vitro*.

80-2326. Nomeir, A. A.; Hajjar, N. P.; Hodgson, E.; Dauterman, W. C. (Toxicol. Program., Dep. Entomol., North Carolina State Univ., Raleigh, NC 27650) ***In vitro* metabolism of EPN and EPNO in susceptible and resistant strains of house flies.** *Pestic. Biochem. Physiol.* 13(2): 112-120; 1980 (21 references).

The acute median lethal doses of EPN and EPNO (EPN oxide) to resistant and susceptible strains of houseflies were determined. EPN was more toxic than EPNO to either strain, and the diazinon resistant strain was approximately more than 9-fold resistant to EPN and 7-fold resistant to EPNO compared to the susceptible strain. The glutathione *S*-transferases were the major routes for EPN metabolism and apparently are the principal resistance mechanism. EPN was metabolized by microsomal fractions via oxidative desulfuration to its oxygen analog EPNO and via oxidative dearylation to *p*-nitrophenol. EPNO was metabolized by the same systems to *p*-nitrophenol, desethyl EPNO, and an unknown metabolite.

80-2327. Cohen, E.; Casida, J. E. (Pestic. Chem. & Toxicol. Lab., Dep. Entomol. Sci., Univ. California, Berkeley, CA 94720) **Inhibition of *Tribolium* gut chitin synthetase.** *Pestic. Biochem. Physiol.* 13(2): 129-136; 1980 (28 references).

The fungicides nikkomycin (0.02 μM) and polyoxin D (4 μM) each inhibited the chitin synthetase (CS) of *Tribolium castaneum* gut by 50%, during *in vitro* assays with 10-min preincubation periods of the enzyme and inhibitor prior to addition of the substrate. Captan, captafol and dichlofluanid were also potent *Tribolium* CS inhibitors. Oxythioquinox and barban moderately inhibited CS, and H-24108, a phenylcarbamate insect growth retardant, was weakly active as an inhibitor of CS activity. Many triazine herbicides and an azido derivative, CGA 19255, were not inhibitory at all. Benzoylphenyl urea insecticides such as diflubenzuron and SIR 8514, potent *in vivo* inhibitors of the polymerization step in insect chitin synthesis, did not affect *T. castaneum* gut CS activity *in vitro* but did stimulate *T. brevicornis* gut CS activity *in vivo*. The findings indicate that gut CS is not sensitive to direct action of benzoylphenyl ureas and that benzoylphenyl ureas act either as CS inhibitors via active metabolites formed in the integument or as blocking agents by direct binding to non-CS sites important in chitin polymerization and fibrillogenesis.

80-2328. Adams, M. E.; Miller, T. A. (Dep. Entomol., Div. Toxicol. & Physiol., Univ. California, Riverside, CA 92521) **Neural and behavioral correlates of pyrethroid and DDT-type poisoning in the house fly, *Musca domestica* L.** *Pestic. Biochem. Physiol.* 13(2): 137-147; 1980 (18 references).

Eleven pesticides, of either the pyrethroid or DDT-type class, were used on house flies to elicit toxic symptoms. The chemicals used included: *trans*-tetramethrin, *S*-bioallethrin, cismethrin, *trans*-permethrin, decamethrin, kadethrin, pydrin, *trans*-barthrin, DDT, GH74, and CRC-12000. The two groups of insecticides could easily be distinguished by the types of symptoms they caused in the flies. Both caused motor unit repetitive backfiring, but temporal development and stability of repetitiveness were distinctly different. Repetitive backfiring always disappeared at low temperatures, but DDT-type backfiring disappeared at lower temperatures than the pyrethroids. A threshold increase in flight motor nerve endings was caused by *trans*-tetramethrin, but did not occur in DDT or *trans*-barthrin poisoning. Uncoupling of the flight motor pattern was noted with pyrethroid exposure, but not with DDT-type exposure. The only chemical of the pyrethroid group which caused both symptoms and physiological aberrations most closely resembling those of the DDT class was *trans*-barthrin.

80-2329. Sudershan, P.; Khan, M. A. Q. (Dep. Biol. Sci., Univ. Illinois, Chicago, IL 60680) **Metabolic fate of ^{14}C photodieldrin in goldfish.** *Pestic. Biochem. Physiol.* 13(2): 148-157; 1980 (30 references).

Goldfish were exposed to ^{14}C-labeled photodieldrin at concentrations of 20 ppb. Within the first 4 hr, a 50% reduction of radioactivity was noted in the water. This was assumed to be due to absorption of photodieldrin by the fish. Within 20 hr, 80% of the

radioactivity had been absorbed. Elimination was slow; a half-life of 3 wk was observed. The major radiocarbons eliminated into the water were photodieldrin (59%), and a ketone derivative (10.4%). An additional 15 polar and nonpolar metabolites were detected. In fish tissues photodieldrin and the ketone derivative residues were the most abundant, accounting for 77 and 5.4% of the radioactivity, respectively.

80-2330. Collins, C.; Kennedy, J. M.; Fahmy, M. A. H.; Miller, T. (Div. Toxicol. & Physiol., Dep. Entomol., Univ. California, Riverside, CA 92521) **Mode of action of sulfenylated carbamates: rapid conversion of *N,N'*-thiodicarbamates to parent carbamate measured by neurophysiological bioassay.** *Pestic. Biochem. Physiol.* 13(2): 158-163; 1980 (14 references).

Three-day-old adult female houseflies of the susceptible strain S_{NAIDM} were exposed to four *N,N'*-thiodicarbamate derivatives of carbofuran. Uncoupled convulsions with similar latencies were induced following topical applications of these chemicals to the cuticle of the flies, in spite of considerable differences in the lipophilic properties of the derivatives. When the chemicals were perfused directly onto the exposed thoracic ganglia in order to assess intrinsic activity, carbofuran acted up to 4.4 times faster than did the derivatives. The suggestion is offered that the N–S bond in each derivative is cleaved soon after application to the cuticle of the house fly and that carbofuran is released in sufficient quantities to allow toxic concentrations to accumulate in the central nervous system at similar rates. This would also account for the small, but significant latent response time to the derivatives when compared with carbofuran following topical application of the chemicals to the cuticle.

80-2331. Puzynska, L. (Dep. Nutr. Ecol., Inst. Food Nutr., PL-02903 Warsaw, Poland) **Oddzialywanie zwiazkow chemicznych wystepujacyh w srodowisku na przemiane lekow u czlowieka. [Effect of environmental chemicals on drug metabolism in humans.]** *Pol. Tyg. Lek.* 35(14): 509-512; 1980 (15 references) (Polish).

Studies on the effects of organochlorine pesticides, polychlorinated biphenyls (PCBs), and of components of cigarette smoke on drug metabolism in humans are reviewed. Organochlorine pesticides, such as DDT, chlordane, lindane, dieldrin, Kepone (chlordecone), and mirex, induced mixed-function oxidases in humans and animals. Significant reduction of the half-life of antipyrine and phenylbutazone was observed under the effect of lindane, DDT, and chlordane. Increased drug elimination can persist for several mo after cessation of exposure to the pesticides.

80-2332. Ohta, H.; Yoshikawa, H. (Sch. Public Health, Fac. Med., Gifu Univ., Gifu, Japan) **[Distribution of copper in the body and in the supernatant phase of the liver-homogenate of mice acutely intoxicated by copper sulfate.]** *Proc. Annu. Meet. Jpn. Soc. Ind. Hyg.* 53: 151-152; 1980 (Japanese).

The effect of preliminary administration of copper on the acute toxicity of copper was studied. At 24 hr after an ip administration of aqueous cupric sulfate (0, 0.4, 1.5 and 2.5 mg Cu/kg) to adult male ddY-rats, a 4.0 mg/kg dose was administered ip. The rats were sacrificed 24 hr after the second administration and the distribution of copper in the heart, lung, liver, kidney, spleen and testis, and in the supernatant liquid of the liver homogenate, was determined. Mortality occurred within 7 days after the second administration in 5 of 10 from the 0.4 mg group, in 3 of 10 from the 1.5 mg group, in 4 of 10 from the 2.5 mg group and in 6 of 10 from the 0 dose group. Cu concentrations in the liver, kidney, spleen and testis of groups given preliminary administrations of 1.5 and 2.5 mg were higher than that of the group not preliminarily administered. Concentrations in the heart and lungs were the same. Cu content in the liver homogenate was higher in 2.5 mg dose group. Preliminary administration of copper sulfate caused higher concentrations of copper in the liver, kidney, spleen and testis. It is concluded that the raised concentration of copper in these organs is related to the lowered toxicity in the pretreated group of mice.

80-2333. Ishizu, S.; Momotani, H.; Sato, M.; Uchiyama, H.; Mori, N. (Sch. Public Health, Tokyo Women's Med. Coll., Tokyo, Japan) **[Experimental studies of intoxication due to methyl bromide – on the biochemical change of the blood.]** *Proc. Annu. Meet. Jpn. Soc. Ind. Hyg.* 53: 303-304; 1980 (Japanese).

Serum enzyme activities were determined for male SD rats (12 animals/group) exposed to methyl bromide 4 hr/day, 5 days/wk, for 6 wk, at concentrations of 200 or 300 ppm. Changes in enzyme activities were found to be dose dependent. LDH, HBD, LAP, CPK, GOT and ALD increased to 1.4-1.5 × the control level. Increased levels of LDH, CPK, GOT and ALD were also observed in human cases of severe methyl bromide intoxication. Rats exposed to methyl bromide exhibited flaccid paralysis, but did not show the muscle spasms expected with severe intoxication. It is suggested that pathohistological examination would have revealed denatured or destroyed images in extremity and heart muscles. Isoenzyme fractions of CPK and LDH were also determined.

80-2334. Sato, M.; Uchiyama, H.; Marinobu, S. (Sch. Public Health, Tokyo Women's Med. Coll., Tokyo, Japan) **[Experimental studies of intoxication due to methyl bromide centered on the persistence of bromine in organs.]** *Proc. Annu. Meet. Jpn. Soc. Ind. Hyg.* 53: 305-306; 1980 (Japanese).

Five-wk-old male SD-rats were exposed to methyl bromide 4 hr/day, 5 days/wk, for 6 wk, at concentrations

of 200, 300 or 400 ppm. After the last exposure the animals were killed, and organ weights and bromine concentrations in some organs were determined. The 200 ppm group exhibited a slight inhibition of body wt gain and no abnormal behavior or clinical symptoms. A large inhibition of wt gain, remarkable debility and paralysis with flexed fore legs and extended hind legs, were shown in the 300 ppm group. In the 400 ppm group the same or more severe symptoms appeared, and 2 of 12 animals died. Animals given 300 or 400 ppm methyl bromide exhibited an increase of the organ wt: body wt ratio for almost all organs. Bromide content in the liver was 15, 15 and 70 μg/g in the 200, 300 and 400 ppm groups, respectively. In the kidney, 100 μg of bromine was detected for all groups. Spleen content was 80 μg in all groups. Possible reasons for the lack of organ bromide level increases with increased levels of methyl bromide in the atmosphere were discussed.

80-2335. Sato, M.; Ishizu, S.; Ikeda, F.; Kishi, R.; Yamamura, K.; Miyake, K. (Sch. Public Health, Tokyo Women's Med. Coll., Tokyo, Japan) **[Behavioral scientific studies on rats exposed to methyl bromide.]** *Proc. Annu. Meet. Jpn. Soc. Ind. Hyg.* 53: 307-308; 1980 (Japanese).

The dose-response (effect) relationship of methyl bromide on the nervous system was studied. Three-wk-old male Wistar rats were subjected to open field tests and rota rod tests. At 10 wk they were exposed to methyl bromide (200 ppm, 4 hr/day, 5 days/wk or 3000 ppm, 4 hr/day, 4 days/wk) for 3 wk. Animals were tested for 20 days beginning 8 days after the last exposure. Ataxia and gait disturbance were not observed. Body wt gain was reduced by exposure, but gradually recovered after exposure ended. Emotivity was not affected by exposure. The time period during which rats could walk on the cylinder in the rota rod test was reduced by exposure to 300 ppm. This was due to disturbance of the peripheral nerve, not disturbance of equilibrating function. Disorder of rhythm of daily behavior was observed in the 300 ppm group. Histological lesions were not observed in the cerebral frontal lobe, parietal lobe, corpus striatum, gray matter around the anterior half of the third cerebral ventricle (including the thalamus and the upper part of chiasma nervorum opticorum), cerebral nerves or cervical nerves.

80-2336. Miyakawa, M.; Hasegawa, H.; Sato, M.; Sudo, A.; Homma, T.; Okonogi, K. (Natl. Inst. Ind. Med., Kawasaki, Kanagawa, Japan) **[Studies on intoxication due to methyl bromide.]** *Proc. Annu. Meet. Jpn. Soc. Ind. Hyg.* 53: 309-310; 1980 (Japanese).

Six groups (5 animals/group) of male CRJ-CD rats were exposed to methyl bromide at concentrations of 10, 20, 40, 60, 100 and 120 ppm for 24 hr, and were killed immediately after exposure. Four other groups of rats were exposed to 40, 60 or 80 ppm methyl bromide for 24 hr, and their general motilities were determined during 2 days before and after exposure by a spontaneous movement measuring apparatus. Mortality rates were 5 of 5 at 120 ppm and 100 ppm after 24 hr; 5 of 5 at 80 ppm and 60 ppm after 48 hr; 4 of 5 at 40 ppm after 72 hr; 4 of 5 at 20 ppm after 144 hr and 2 of 5 at 10 ppm after 216 hr. Gait disturbance, respiratory failure, salivation, paralysis, tremor and intermittent spasms were observed before death. Hemorrhage in the lungs was observed. Reduction of liver wt and increased adrenal and testes wt were noted. Increased glycogen in the heart (10-60 ppm), decreased glutathion in the lung (10-60 ppm), decreased glycogen in the liver, increased hemoglobin and increased neutral fat in the blood were observed. Reduction of general motility was observed after exposure to 60 and 80 ppm for 24 hr. Individuals surviving exposure to 120 ppm for 24 hr showed gait disturbance for 2 mo and were incapable of balancing on a rod.

80-2337. Sasaki, Y.; Aoki, M.; Nishimura, M. (Sch. Hyg., Tokyo Den. Coll., Tokyo, Japan) **[Studies on the effect of an organophosphorus pesticide on the muscles of mastication of rats intoxicated by the pesticide. II. On the relationship between the symptom of intoxication and the amounts of saliva adsorbed on filter paper.]** *Proc. Annu. Meet. Jpn. Soc. Ind. Hyg.* 53: 333-334; 1980 (1 reference) (Japanese).

The influence of organophosphate pesticide intoxication on saliva secretion was studied. Six-wk-old male Wistar rats (130-160 g body wt) were administered fenitrothion po at 5, 10, 20, 40 and 80 mg/kg. Increased saliva was measured as an amount of adsorbed saliva on a sheet of filter paper. Saliva secretion was compared with the activity of cholinesterase in blood. The function of muscles of mastication of the rat was also determined. Fenitrothion at all dose levels affected muscle function; maximum amplitude was reduced and the frequency of opening and shutting the mouth was changed. The secretion of saliva of control rats had a normal distribution. With administration of fenitrothion, the amount of saliva adsorbed on filter paper showed a peak after 1-2 hr, coinciding with the appearance of symptoms such as hair-rising, tremor, salivation and incontinence. The adsorbed amount of saliva 3 hr after administration and the erythrocyte cholinesterase activity showed a correlation (correlation coefficient of 0.56) significant at 95%.

80-2338. Ali, S. F.; Chandra, O.; Hasan, M. * (Brain Res. Cent., Jawaharlal Nehru Med. Coll., Aligarh Muslim Univ., Aligarh 202001, India) **Effects of an organophosphate (dichlorvos) on open field behavior and locomotor activity: correlation with regional brain monoamine levels.** *Psychopharmacology* 68(1): 37-42; 1980 (20 references).

Dichlorvos, administered ip at 3 mg/kg daily for 10 days to albino rats, caused no significant behavioral disorders. Mild irritability, salivation, muscular twitches

and sedation were occasionally noted, however, over the 10 day period. Ambulation, rearing, preening and defecation were each depressed in open field experiments after treatment with dichlorvos. No significant changes in motor activity were noted during the first 2 days of drug treatment. Significant reduction was noted from day 3 onwards, with a peak decrease in activity on day 7. NE, DA and 5-HT monoamines were shown to demonstrate similar patterns of activity over the test period. DA was significantly decreased on days 5 and 7 in the cerebellum and brain stem. The cerebral hemisphere indicated a decrement only on day 7. On day 10 there was almost no change in DA concentration in cerebral hemisphere and cerebellum, but there was a 13% recovery in the brain stem.

80-2339. Robinson, C. P.; Pento, J. T. (Pharmacodynam. & Toxicol., Coll. Pharm., Health Sci. Cent., Univ. Oklahoma, Oklahoma City, OK 73190) **The effects of U-40481, demethylchlordimeform, and formetanate on calcium flux in the isolated rabbit aorta.** *Res. Commun. Chem. Pathol. Pharmacol.* 28(2): 215-228; 1980 (17 references).

Three formamidine pesticide or pesticide metabolites were tested for their effects on the calcium flux in rabbit aorta. The three chemicals were DCDF (*N*-(4-chloro-*O*- tolyl)-*N*-methylformamidine), the *N*-monodemethylated metabolite of CDF; U-40481 (*N*-methyl-Λ′- 2,4-xylyl formamidine), a metabolite of amitraz; and (*N,N*-dimethyl- *N′*-(3-([(methyl- amino)carbonyl]oxy) phenyl)- methanimidamide), an ester of *N*-methyl carbamic acid. U-40481 caused a reduction in the rate of uptake of calcium and norepinephrine stimulated uptake of calcium. U-40481 also reduced the norepinephrine stimulated efflux from calcium-loaded, superfused aorta strips. Neither demethylchlordimeform nor formetanate changed calcium uptake or enhanced calcium flux. It is suggested that the effect of U-40481 on calcium uptake which was not stimulated may have resulted from an uncoupling oxidative phosphorylation. The reduction of norepinephrine induced calcium flux may have resulted from antagonism at receptors of norepinephrine.

80-2340. Harvey, J.; Palmer, D. (Pulm. Physiol. Lab., John Muir Mem. Hosp., Walnut Creek, CA) **Pulmonary complications of ingestion of the herbicide paraquat: a case report.** *Respir. Care* 25(5): 573-575; 1980 (7 references).

A 36-yr-old male intentionally ingested approximately 2 shot glasses of the herbicide paraquat. Gastric lavage was performed several hr later when the patient was hospitalized. Introduction of 30% bentonite clay was also achieved, followed by hemoperfusion via femoral vein catheters, continued intermittently through the 11th day of hospitalization. On the third day of hospitalization treatment was begun with superoxide dismutase. He was discharged 23 days after ingestion of the herbicide. Pulmonary function studies performed 60 days after ingestion showed a resolved restrictive defect and normal diffusion capacity. Arterial blood gase and pH were normal. It is suggested that the complete recovery of this patient was achieved due to immediate therapy directed at prevention of paraquat absorption, elimination of paraquat by hemoperfusion and reduction of free radicals.

80-2341. Motoyama, N.; Dauterman, W. C. (Lab. Environ. Biol., Fac. Hortic., Chiba Univ., Matsudo, Japan) **Glutathione *S*-transferases: their role in the metabolism of organophosphorus insecticides.** *Rev. Biochem. Toxicol.* 2: 49-69; 1980 (76 references).

General types of reactions of glutathione *S*-transferases with organophosphorus insecticides are discussed. Attention is also given to the O-alkyl conjugation of phosphorodithioates, phosphorothiolates, phosphorothionates and phosphates. Discussion is presented on the O-aryl conjugation of phosphorothionates, phosphates, phosphonothionates and phosphonates. The phosphonate conjugation of phosphonothionates is considered. Topics discussed also include the non-enzymatic breakdown of metabolites, endogenous inhibitors, the identity of the enzymes, the role of glutathione *S*-transferases in selective toxicity and mechanisms of resistance.

80-2342. Neal, R. A. (Cent. Environ. Toxicol., Dep. Biochem., Sch. Med., Vanderbilt Univ., Nashville, TN 37232) **Microsomal metabolism of thiono-sulfur compounds: mechanisms and toxicological significance.** *Rev. Biochem. Toxicol.* 2: 131-171; 1980 (89 references).

The microsomal metabolism of thiono-sulfur containing compounds is extensively reviewed. The relationship between this metabolism and the toxic effects observed in mammals exposed to these compounds is discussed. The metabolism of parathion is used to exemplify this relationship. Mammalian microsomal metabolism of carbon-centered thiono-sulfur containing compounds is also discussed using carbon disulfide, thioacetamide, methimazole, and α-naphthylthiourea (ANTU) as examples. It is suggested that the covalent binding of atomic sulfur released in the cytochrome P-450 monooxygenase-catalyzed metabolism of thiono-sulfur compounds is responsible for monooxygenase activity being inhibited. Damage to liver and possibly lung edema and neoplasia result from the covalent binding of the electrophilic S-oxides, S-dioxides or carbene derivatives of these S-oxides and S-dioxides to tissue macromolecules.

80-2343. Crocker, J. F. S.; Ozere, R. L. (Dep. Pediat., Izaak Walton Killam Hosp. Child., Halifax, Nova Scotia,

Canada) **The incidence and etiology of Reye's syndrome in eastern Canada.** In: *Reye's Syndrome II.* Crocker, J. F. S., ed. (Grune & Stratton: NY): pp. 3-12; 1979 (12 references).

The efforts to establish a link among intrinsic or extrinsic toxins, which cause abnormal reactions by a susceptible host to specific groups of viruses, to the etiology of Reye's syndrome are discussed. A survey of plasma cholinesterase (PChE) and red blood cell acetylcholinesterase (AChE) levels in children from eastern Canada with Reye's syndrome are reported. An animal model was designed to test whether chemicals can alter responses of the host to viral infections which normally are relatively benign. Swiss mice were dermally exposed to an LD50 dose of DDT, fenitrothion, combinations of DDT + fenitrothion, or Toximul MP8 + Atlox 3409 + Aerotex 3470 from day 2 through day 12. On day 14 encephalomyocarditis virus was injected. Results from the emulsifier + virus group significantly indicate that the emulsifying agents were responsible for altering the host response to a sublethal dose of virus. Attempts to use Hormel Pigmee pigs as a larger animal model gave similar results but the numbers obtained were not large enough to draw clear-cut conclusions.

80-2344. Safe, S.; Hutzinger, O.; Crocker, J. F. S. (Dep. Chem., Univ. Guelph, Guelph, Ontario, Canada) **The role of chemicals in Reye's syndrome.** In: *Reye's Syndrome II.* Crocker, J. F. S., ed. (Grune & Stratton: NY): pp. 281-309; 1979 (47 references).

A review of human and animal model studies on the role of chemicals in the etiology of Reye's syndrome is presented. Aflatoxins, salicylates, warfarin, lindane and other xenobiotics have been implicated in Reye's syndrome by epidemiological and clinical surveys. In animal models, fatty acids, virus-pesticide (particularly DDT and fenitrothion) synergy, virus-surfactant synergy and virus-solvent synergy, as well as solvent and surfactant perturbation of lipid metabolism and membrane structures have all been investigated for their roles in causing Reye's syndrome. Persistent aromatic pesticides and pollutants, including DDT, BHC, oxychlordane, mirex, endrin, toxaphene, aromatic and volatile hydrocarbons and industrial chemicals, are suggested to serve as sources of constant exposure to and relatively permanent body reservoirs of toxic substances which can then synergistically react in either a viral-chemical or chemical-chemical manner to play a major role in Reye's syndrome and other chemically related diseases.

80-2345. Piechocka, J. (Dep. Foodst. Res. & Appl., State Inst. Hyg., Warsaw, Poland) **Badanie toksycznosci tiuramu na szczurach. [Tiuram toxicity testing in rats].** *Rocz. Panstw. Zakl. Hig.* 31(1): 67-72; 1980 (22 references) (Polish).

Rats were fed food contaminanted with tiuram (thiram) at concentrations of 3, 30 and 300 mg/kg over a 12 mo period. Central nervous system effects were noted along with a significant rise in the weight of specific organs. The white blood cell count rose significantly in rats receiving the 300 mg/kg dose level. Increases were also noted in AspAT and AlAT activities. In this same group of animals a rise in the level of total protein, α_1 and α_2 globulins was noted with a fall in α globulin levels. Peritubular and intratubular fibroadenoma and adenoma of the breast was found in 2 of the animals.

80-2346. Sciezynska, H.; Urbanek-Karlowsaka, B. (Dep. Foodst. Res. & Appl., State Inst. Hyg., Warsaw, Poland) **Wplyw octanu fenylorteciowego na aktywnosc 4-hydroksylazy aniliny i demetylazy *p*-nitroanizolu w watrobie szczura. [Effects of phenylmercury acetate on the activity of aniline 4-hydroxylase and *p*-nitroanisole demethylase in rat liver.]** *Rocz. Panstw. Zakl. Hig.* 31(1): 73-77; 1980 (13 references) (Polish).

Phenylmercury acetate (PMA) was given to rats in their drinking water at concentrations of 5 or 50 mg Hg/l. Determinations of aniline 4-hydroxylase and *p*-nitroanisole demethylase activities were made after 2, 4 and 12 wk of exposure. Phenylmercury acetate decreased the activity of hepatic aniline 4-hydroxylase, but did not cause significant changes in the level of *p*-nitroanisole demethylase. Rats on industrial diets had a higher activity of *p*-nitroanisole demethylase than animals receiving a semisynthetic diet. The activity of aniline 4-hydroxylase was not influenced by the type of diet.

80-2347. Yomura, Y.; Shibata, N. (Dep. Inter. Med. I, Fac. Med., St. Marianna Univ., Kawasake, Kanagawa, Japan) **[Studies on intoxication due to intake of food fumigated with methyl bromide. III. The second experiment of maintaining infantile rats on synthetic diet fumigated with methyl bromide.]** *St. Marianna Ikadaigaku Zasshi (St. Marianna Med. J.)* 17(4): 342-356; 1979 (13 references) (Japanese).

Nine juvenile, female Wistar rats (35-53 g) were maintained on a methyl bromide treated diet for 42 wk. Seven rats were maintained as the control group. A high incidence of slight decrease in body weight gain, discolored hair and skin, periocular discoloration of the eyes, mild diarrhea, adynamia, excitation and softening of the abdominal wall were observed. Macroscopic abnormalities were not remarkable upon autopsy. In one case, degeneration of the peripheral nerves and posterior column of the spinal cord and mild inflammatory cellular infiltration of the spinal ganglia and choroid plexus were noted. It is concluded that methyl bromide ingestion leads to disturbances in pantothenic acid metabolism and may be related to subacute myelo-optic neuropathy.

80-2348. Varanka, I. (Biol. Res. Inst., Hungarian Acad. Sci., Tihany, Hungary) **Effect of some pesticides on the rhythmic adductor muscle activity of freshwater mussel larvae.** *Symp. Biol. Hung.* 19: 177-196; 1979 (19 references).

Exposure to the insecticides Hungaria L-7 (AI 7% lindane), Dimecron-50 (50% phosphamidon, Thimet-10 (10% phorate), Novenda (25% DNOC), Bi-58 EC (36% dimethoate) and malathion; the nematocide Shell-DD (dichloropropane + dichloropropene); and the herbicides Gramoxone (25% paraquat dichloride), dikonirt (75% 2,4-D) and 2,4-D salt, inhibited the TA-induced activity of adductor muscles of freshwater mussel larvae. It is suggested that the TA-induced adductor muscle activity of glochidia may be used as an index of the effect of inhibitory compounds. The inhibitory concentrations of the compounds used in this study which resulted in 50% inhibition of the activity ranged from 1.8 to 600 ppm. When the 30 min exposure time was extended, the effective inhibitory concentration decreased, indicating that the sensitivity of the method may be higher.

80-2349. Dean, M. E.; Smeaton, T. C.; Stock, B. H.* (Sch. Pharm., South Australian Inst. Technol., Adelaide 5000, Australia) **The influence of fetal and neonatal exposure to dichlorodiphenyltrichloroethane (DDT) on the testosterone status of neonatal male rat.** *Toxicol. Appl. Pharmacol.* 53(2): 315-322; 1980 (21 references).

The testicular synthesis and hepatic metabolism of testosterone and the plasma concentrations of androgens were measured in 2-, 4-, 6-, or 10-day-old male rats after a 10-day prenatal and variable postnatal exposure to dichlorodiphenyltrichloroethane (DDT) via maternal milk secretion. While there were significant elevations in the metabolism of testosterone and aminopyrine by liver microsomes from DDT-exposed rats there were no compensatory changes in either serum androgens or testicular synthesis of testosterone. The failure of DDT exposure to change plasma concentrations of androgens in spite of substantial increase in hepatic metabolism was further confirmed in male rats treated with human chorionic gonadotrophin to produce elevated testosterone concentrations. Tissue analysis showed ^{14}C-labeled DDT and/or its metabolites crossed the placenta and was present in fetal rats (day 21), but cross fostering of litters from treated and control rats indicated that the major response to DDT occurs upon exposure after birth. It is suggested that hepatic enzyme induction by DDT is essentially a postnatal phenomenon and the DDT is transferred in substantial amounts from the milk of lactating rats to their offspring. (Author abstract by permission)

80-2350. Abou-Donia, M. B.; Graham, D. G.; Timmons, P. R.; Reichert, B. L. (Dep. Pharmacol., Med. Cent., Duke Univ., Durham, NC 27710) **Late acute, delayed neurotoxic and cholinergic effects of *S,S,S*-tributyl phosphorotrithioite (merphos) in hens.** *Toxicol. Appl. Pharmacol.* 53(3): 439-457; 1980 (26 references).

This study reports 3 toxicologic effects of *S,S,S*-tributyl phosphorotrithioite (merphos) in hens: acute cholinergic, late acute, or delayed neurotoxic. These effects can be differentiated by route of administration, dosage required, severity and reversibility of clinical signs, and production of pathologic lesions of the nervous system. Oral administration of single dose (200-2000 mg/kg) of merphos caused weak cholinergic effects, which were rapidly relieved by atropine sulfate treatment. Four days after start of administration of large daily doses (80 mg/kg/day) a late acute effect was observed. The clinical signs of the late acute effects were identical to those produced by *n*-butyl mercaptan (*n*BM), a hydrolytic product of merphos, and were not relieved by atropine sulfate. The late acute effect overlapped with the topical application of single or daily doses of merphos; rather, delayed neurotoxicity was consistently produced. Degeneration of the anterior columns in the spinal cord was identical to that found in tri-*o*-cresyl phosphate-treated hens and was the most consistent histopathologic change. Topical administration of merphos caused a more prolonged inhibition of plasma butyrylcholinesterase activity than the orally administered compound. Orally administered merphos was rapidly metabolized in the gastrointestinal tract directly to *n*-BM or following its oxidation to *S,S,S*-tributyl phosphorotrithioate. *n*BM apparently caused the late acute toxic effect. Topically administered merphos, which was not metabolized in the gastrointestinal tract, caused delayed neurotoxicity but did not produce a late acute effect. The present results demonstrate that evaluation of the neurotoxic effect of organophosphorus esters should include investigation with both oral and topical application. (Author abstract by permission)

80-2351. Murray, F. J.; Schwetz, B. A.; Balmer, M. F.; Staples, R. E. (Syntex Corp., Stanford Ind. Park, Palo Alto, CA 94304) **Teratogenic potential of hexachlorocyclopentadiene in mice and rabbits.** *Toxicol. Appl. Pharmacol.* 53(3): 497-500; 1980 (8 references).

Hexachlorocyclopentadiene (HCCPD) is a chemical intermediate used in the manufacture of certain pesticides, such as mirex, Kepone (chlordecone) and chlordane. The teratogenic potential of HCCPD was evaluated in CF-1 mice and New Zealand white rabbits. Mice were given 0, 5, 25 or 75 mg HCCPD/kg/day by gavage from days 6 to 15 of gestation; rabbits were given the same dose levels of HCCPD by gavage from days 6 to 18 of gestation. No maternal toxicity or embryotoxicity was observed in mice given HCCPD. In rabbits, significant toxicity occurred in dams given 75 mg HCCPD/kg/day, but little evidence of embryotoxicity was noted. A teratogenic effect was not detected in either species. (Author abstract by permission)

80-2352. Eto, M.; Seifert, J.; Engel, J. L.; Casida, J. E.* (Pestic. Chem. & Toxicol. Lab., Dep. Entomol. Sci., Univ. California, Berkeley, CA 94720) **Organophosphorus and methylcarbamate teratogens: structural requirements for inducing embryonic abnormalities in chickens and kynurenine formamidase inhibition in mouse liver.** *Toxicol. Appl. Pharmacol.* 54(1): 20-30; 1980 (17 references).

The methylcarbamate insecticide carbaryl and the organophosphorus (OP) insecticides diazinon and dicrotophos inhibit chicken embryo kyneurenine formamidase (KFase) which results in a decreased concentration of NAD in the embryo and abnormal feathering and micromelia. These compounds are also potent *in vivo* inhibitors of mouse liver KFase. About 80 OP compounds and carbamates were synthesized or obtained to examine the structural requirements for *in vitro* or *in vivo* mouse liver KFase inhibition and teratogenic potency when injected into hen eggs. Compounds newly recognized as potent *in vitro* or *in vivo* KFase inhibitors and as teratogens include: the dimethyl-carbmate analog of carbaryl; 10-dialkyl phosphate and dialkyl phosphorothionate analogs of diazinon with varied 2- and 6-pyrimidyl substituents; 3- and 4- but not 2-pyridyl diethyl phosphorothionates; 2-pyridon-4-yl diethyl phosphorothionate with some structural similarities to dicrotophos; pyrizinyl diethyl phosphorothionate; the cyclic ethyl phosphorothionate of 2-hydroxymethyl-6-methyl-3-pyridinol. The position, size, and branching of *N*-heterocyclic ring substituents in the OP compounds determine their potency and the type of teratogenic signs produced. The ethyl phenylphosphonate and ethyl phenylphosphonothionate analogs of diazinon are not active *in vivo* nor are a variety of OP compounds and carbamates modeled after *N*-formyl-L-kynurenine, the KFase substrate. (Author abstract by permission)

80-2353. Deacon, M. M.; Murray, J. S.; Pilny, M. K.; Rao, K. S.; Dittenber, D. A.; Hanley, T. R., Jr.; John, J. A. (Toxicol. Res. Lab., Health & Environ. Sci., Dow Chem. Co. USA, Midland, MI 48640) **Embryotoxicity and fetotoxicity of orally administered chlorpyrifos in mice.** *Toxicol. Appl. Pharmacol.* 54(1): 31-40; 1980 (13 references).

Pregnant CF-1 mice were given 0, 1, 10 or 25 mg/kg/day of chlorpyrifos by gavage on days 6 through 15 of gestation. Severe maternal toxicity was observed among pregnant mice give 25 mg/kg of the test compound. Plasma and erythrocyte cholinesterase (ChE) levels were significantly reduced among maternal mice at all dosages. Fetotoxicity was noted among litters of mice given 25 mg/kg of chlorpyrifos as evidenced by decreased fetal body measurements and an increased incidence of minor skeletal variants. An increase in the incidence of exencephaly was observed among litters of mice at the lowest dosage, 1 mg/kg/day, but not at 10 or 25 mg/kg. Additional groups of mice were given 0, 0.1, 1 or 10 mg chlorpyrifos/kg/day on days 6 through 15 of gestation. Plasma and erythrocyte ChE levels were significantly decreased among maternal mice at 1 and 10 mg/kg but not at the lowest dosage, 0.1 mg/kg. No evidence of a teratogenic response was observed in these mice. Thus, since exencephaly was not repeatable and was not found at 10- and 25-fold higher dose levels in the original study, chlorpyrifos was not teratogenic in mice at dose levels up to 25 mg/kg/day. (Author abstract by permission)

80-2354. James, R. W.; Heywood, R.; Crook, D. (Huntingdon Res. Cent., Huntingdon, Cambridge PE18 6ES, England) **Quantitative aspects of spermatogenesis in rats and dogs after repeated hexachlorophene treatment.** *Toxicol. Lett.* 5(6): 405-412; 1980 (31 references).

Sprague-Dawley rats of the CD strain received hexachlorophene at 5 mg/kg/day orally for 9 wk. Dogs similarly treated received the chemical at dose levels of 3 mg/kg/day. Observation was continued on some of the animals for a further 13 wk period. No effects were noted on the serum concentrations of pituitary gonadotrophin and testosterone in either species. Dogs exhibited no changes in testicular dimensions or semen characteristics and no macroscopic post mortem abnormalities, organ wt differences of lesions in the testes, pituitaries or secondary sex organs were observed. Rats exhibited transient reductions in the number of germ cells in cross-sections of seminiferous tubules 4 wk after treatment. Canine seminiferous tubules contained reduced spermatogonial counts 9 wk after treatment. The study demonstrated that repeated treatment with hexachlorophene did not induce significant impairment of spermatogenesis in rats or dogs.

80-2355. Leighty, E. G.; Fentiman, A. F., Jr.; Thompson, R. M. (Battelle, Columbus Lab., Columbus, OH 43201) **Conjugation of fatty acids to DDT in the rat: possible mechanism for retention.** *Toxicology* 15(2): 77-82; 1980 (6 references).

The production of fatty acid conjugates of DDT in an *in vitro* microsomal system from the hydroxylated DDT metabolite DDOH and the retention of these conjugates were studied using rats given chronic ip injections of DDT. The study demonstrated the successful conjugation of DDT to fatty acids is such a system and the retention of the conjugates in the liver and spleen of the test animals. It is suggested that the conjugation of fatty acids to foreign compounds may be part of the mechanism by which such substances as DDT are retained in fat, lipid-containing tissues, and body cells, thus leading to their toxicity to the animal. This conjugation would allow the chemical to exert a long term low exposure direct effect on the cell at its point of attachment.

80-2356. Sakai, R. K.; Baker, R. H.; Javed, S. (Pakistan Med. Res. Cent., Lahore, Pakistan) **Genetic and**

linkage analyses of dieldrin resistance in *Anopheles culicifacies* Giles. *Trans. R. Soc. Trop. Med. Hyg.* 73(4): 445-450; 1979 (13 references).

Formal genetic analysis of dieldrin resistance in *Anopheles culicifacies* and its linkage relationship to sex and 2 autosomal loci: maroon eye, linkage group 2 and acid phosphatase, linkage group 3, are presented. Results of dieldrin tests of the susceptible and resistant strains, the reciprocal crosses between the 2 strains and the appropriate controls suggest that the F_1 adults from the susceptible × resistant crosses show intermediate resistance in comparison to the parental strains. The findings on the back crosses of the heterozygous females to the parental strains suggest that dieldrin resistance is mono-factorial and incompletely dominant. Results of heterozygous male backcrosses are in agreement with this finding. These data also suggest that dieldrin resistance is not under the control of a sex-linked locus; the X^2 testing for linkage between sex and dieldrin are not significant. In studies on the relationship among maroon eye, *ma* and dieldrin, it was indicated that *Dl* and *ma* segregate independently of each other and suggest that sex segregates independently of *Dl* and *ma*. The dieldrin resistance was found to be under the control of codominant alleles of a locus in linkage group 3 (chromosome 3) approximately 31 map units from acid phosphatase.

80-2357. Narbonne, J. F. (Lab. Physiol. Nutr., F-33405 Talence, France) **Transport des pesticides chez les vertebres. [Pesticide transport in vertebrates.]** *Trav. Soc. Pharm. Montpellier* 39(4): 235-258; 1979 (31 references) (French).

Routes of absorption, distribution and excretion of pesticides in vertebrates are discussed. Pesticide transport in vertebrates by trans-membraneal passage, absorption through the skin, pulmonary absorption, absorption from the gastrointestinal tract, pesticide distribution in the body, accumulation in tissues, linkage to plasma proteins, fixation in the liver and kidneys, deposition in fat, bones, brain, passage through the placenta, and urinary and biliary excretion are described. The intensity of pesticide flux (kinetics of different modes of transport) in the body of vertebrates is identified as a factor determining their toxicity. Long-term toxicity is attributed to incomplete elimination. The substances discussed include PCBs and the pesticides DDT, dieldrin, parathion, carbaryl, and hexachlorobenzene.

80-2358. Mitjavila, S.; Carrera, G. (U-87, Inst. Physiol. 2, INSERM, F-31400 Toulouse, France) **Toxicite potentielle du DDT au cours de la restriction alimentaire et de la realimentation. [Potential DDT toxicity induced by feed restriction and subsequent realimentation.]** *Trav. Soc. Pharm. Montpellier* 39(4): 345-346; 1979 (French).

The potential change in the degree of toxicity of liposoluble pesticides, such as DDT, during starvation was studied. Rats were fed DDT for 52 days, then starved to reduce the amount of body fat. Starvation induced rapid mobilization of stored DDT. The half-life of DDT in the fat was reduced from a norm of 3 mo in animals on a regular diet to 3 days. DDT was distributed differently in starved animals from those which died from acute intoxication. The brain and liver of starved rats contained only 20% of the DDT levels found in the brain and liver of intoxicated animals. In spite of the rapid mobilization of DDT no abnormal neuro-motor or other toxic symptoms were noted in the starved rats.

80-2359. Periquet, A.; Thouvenot, J. P.; Cambon, C.; Derache, R. (Groupe Rech. Toxicol. Aliments Boissons, F-31400 Toulouse, France) **Toxicite des pesticides et teneur proteique du regime alimentaire. [The relationship of pesticide toxicity to the protein content of the diet.]** *Trav. Soc. Pharm. Montpellier* 39(4): 361-361; 1979 (French).

The degree of toxicity of pesticides fed to rats was found to vary with the protein level of their diet. In rats on a low protein diet the LD50 of DDT increased by an index of 4, carbaryl by an index of 8, lindane by an index of 12, endosulfan by an index of 20 and captan by an index of 2100. This was confirmed by feeding low doses of the dithiocarbamate containing pesticide nabam to rats on a low protein diet. It is suggested that, for example, the 15 ppm maximum permissible residual level of captan on fruits and vegetables, authorized in many developed countries, does not apply to undernourished populations in South America, Africa and Asia.

80-2360. Cambon, C.; Periquet, A.; Derache, R. (Unite U-87, Groupe Rech. Toxicol. Aliments Boissons, INSERM, F-31400 Toulouse, France) **Repartition des isoenzymes d'acetylcholinesterases cerebrales maternelles et foetales apres administration de derives carbamates insecticides. [Distribution of maternal and fetal acetylcholinesterase isoenzymes following the administration of carbamate insecticide derivatives.]** *Trav. Soc. Pharm. Montpellier* 39(4): 362; 1979 (French).

The site of fixation of the carbamate based insecticides aldicarb, carbaryl, carbofuran and pirimicarb to fetal and maternal rat brain acetylcholinesterases(AChE) following oral administration of small quantities of these substances to rats at day 18 of gestation was studied. AChE isoenzymes were seperated by polyacrylamide gel electrophoresis. In the case of rat brain ChE fixation was found to occur preferentially to the less mobile isoenzyme number 1. Following ingestion of the insecticides by the mother, the level of fetal isoenzyme number 1 was also found to have been significantly reduced, but this fixation is not specific and extended also to isoenzyme number 2 when aldicarb and carbofuran were fed.

80-2361. Akhlynina, T. B.; Buzhurina, I. M.; Iano', M. A.; Rozovskaya, I. A. (Res. Lab. Mol. Biol. & Bioorg. Chem., M. V. Lomonosov State Univ., Moscow, USSR) **Vliyanie tsiklogeksimida, 2,4-dinitrofenola i papaverina na sintez ribosomal' noi rnk v kletkakh astsitnoi kartsinomy erlikha. [The influence of 2,4-dinitrophenol, papaverine and cycloheximide on RNA synthesis in the Ehrlich ascites tumor cells.]** *Tsitologiya* 21(1): 84-89; 1979 (16 references) (Russian).

The effect of papaverine, 2,4-dinitrophenol (DNP), and cycloheximide (CH) on RNA synthesis was studied in a culture of Ehrlich ascites carcinoma cells. At a high concentration of cells in suspension (3×10^7 cells/ml), all 3 agents inhibited synthesis of high molecular weight RNA precursor. At 10^6 cells/ml, all 3 agents ceased to inhibit synthesis of ribosomal RNA. CH inhibited incorporation of labelled amino acids into the protein fraction of cells; protein synthesis was inhibited by 85-90% at a cell concentration of 5×10^7 cells/ml and by 80-85% at 10^6 cells/ml. DNP was found to decrease the concentration of endogenous ATP (by 50% at 5×10^7 cells/ml and by 70% at 10^6 cells/ml).

80-2362. Verma, S. R.; Rani, S.; Bansal, S. K.; Dalela, R. C. (Pollut. Relevant Res. Lab., Dep. Zool., D.A.V. (P.G.) Coll., Mazaffarnagar 251001, India) **Effects of the pesticides Thiotox, dichlorvos and carbofuran on the test fish *Mystus vittatus*.** *Water Air Soil Pollut.* 13(2): 229-234; 1980 (13 references).

Combinations of two of three pesticides, Thiotox (endosulfan), dichlorvos, and carbofuran, were prepared so that one of the two was fixed at a no-effect concentration level while the other pesticide was increased to obtain the entire dose response curve. When interactions of all three pesticides were studied, two of the pesticides were fixed at concentrations which when combined, produced no effect on the test organisms, and the concentration of the third changed so that a dose-response curve was obtained. The test species used in these studies was the fish *Mystus vittatus*. The study demonstrated that the toxicity of most pesticide combinations were synergistic. The most toxic was Thiotox + dichlorvos in combination with carbofuran. Dichlorvos + Thiotox at various concentrations and carbofuran + Thiotox were the least toxic. It is noted that a particular combination of chemicals could be either synergistic or additive, depending on the relative dose used.

80-2363. Deal, L. M.; Reeves, J. T.; Larkins, B. A.; Hess, F. D. (Dep. Bot. & Plant Pathol., Purdue Univ., West Lafayette, IN 47907) **Use of an *in vitro* protein synthesizing system to test the mode of action of chloracetamides.** *Weed Sci.* 28(3): 334-340; 1980 (27 references).

The effects of chloracetamides on protein synthesis were studied both *in vivo* and *in vitro*. Four chloracetamide herbicides, alachlor [2-chloro-2′,6′-*diethyl-N*-(methoxymethyl) acetanilide], metolachlor [2-chloro-*N*-(2- ethyl-6-methylphenyl) -*N*-(2-methoxy- 1-methylethyl) acetamide], CDAA (*N,N*-diallyl-2-chloroacetamide), and propachlor (2-chloro-*N*-isopropyl acetanilide) were tested for inhibiton of [^{3}H]-leucine incorporation into protein. Incorporation of ^{3}H-leucine into trichloracetic acid (TCA)-insoluble protein was inhibited in oat (*Avena sativa* L. Victory) seedlings grown in sand culture and treated 12 hr at 1×10^{-4} *M* with these chloracetamides. The herbicides were also tested in a cell-free protein synthesizing system containing polyribosomes purified from oat root cytoplasm. These herbicides had no effect on the rates of polypeptide elongation nor on the synthesis of specific polypeptides when herbicides (1×10^{-4} *M*) were added directly to the system. Polypeptide formation was inhibited 89% when 1×10^{-4} *M* cycloheximide was added during translation. Cytoplasmic polyribosomes were isolated from oat roots treated 12 hr with 1×10^{-4} *M* herbicide. Translocation rates and products were not altered when these polyribosomes were added to the *in vitro* system. Protein synthesis is inhibited when tested in an *in vivo* system; however the inhibition does not occur during the translation of mRNA into protein. (Author abstract by permission)

80-2364. Nawrot, A. (Dep. Intern. Med. I, ZOZ Hosp., PL-43400 Cieszyn, Poland) **Jednoczesne zatrucie alkoholem etylowym i zwiazkiem fosforoorganicznym. [Simultaneous intoxication with ethanol and an organophosphorus compound.]** *Wiad. Lek.* 32(3): 183-184; 1980 (6 references) (Polish).

An inebriated 27-yr-old man attempted suicide by ingestion of 500 ml of Foschlor 50 (50% trichlorfon). The blood alcohol level was 0.25% at hospitalization. After intubation, atropine and pralidoxime (1 mg) were administered iv. A total atropine dose of 56 mg was administered within the first 6 hr, which caused considerable alleviation of the respiratory disorders and low blood pressure. The patient was discharged in good condition after 9 days.

80-2365. Rudak-Zakrzewska, A. (Dep. Allergol., Inst. Intern. Med., Med. Acad., PL-15276 Bialystok, Poland) **Zatrucia pestycydami fosforoorganicznymi – mechanizm dzialania, objawy kliniczne i leczenie. [Poisoning with organic phosphorus pesticides – mechanism of action, clinical manifestations and treatment.]** *Wiad. Lek.* 33(1): 15-18; 1980 (15 references) (Polish).

Studies and observations on poisoning with organophosphorus pesticides are reviewed. Organophosphorus pesticides have a muscarin-like effect due to the accumulation of acetylcholine at the nerve endings. Systox (demeton) and parathion were found to have a skin irritating effect. These pesticides cause disorders in the production of hydrochloric acid and enzymes in the

gastric juice. Parathion is a potent inhibitor of gastric juice in humans. Increased leukocyte count, reduced erythrocyte count, reduced blood sugar level, and necrotic and other changes in the myocardium were found during the acute poisoning of rabbits with Intrathion (morphothion). Determination of the cholinesterase activity is of primary importance in the diagnosis of poisoning with organophosphorus pesticides. Oximes and hydroxamic acids are effective antidotes of organophosphorus compounds.

80-2366. Hayashi, A. (Lab. Med. Zool., Chiba Prefect. Lab. Hyg., Chiba, Japan) **[Agricultural chemicals and their application. XIV. Noxious insects against sanitation and diazinon.]** *Yakkyoku (J. Pract. Med.)* 31(4): 459-466; 1980 (Japanese).

The physico-chemical properties, insecticidal activity, metabolism in plants and animals and the acute and subacute toxicities of diazinon are reviewed. The oral, percutaneous and inhalation LD50s of diazinon in different experimental species are tabulated and compared to lindane and DDT. Also tabulated are the thin layer chromatography R_f values, the gas chromatography retention time and the cholinesterase activities of 12 diazinon metabolites. The persistance of diazinon was compared to other organophosphorus insecticides and the soil half-life was found to be 22 days.

See also 80-2104, 80-2106, 80-2107, 80-2108, 80-2109, 80-2110, 80-2111, 80-2112, 80-2113, 80-2114, 80-2115, 80-2119, 80-2120, 80-2122, 80-2124, 80-2125, 80-2127, 80-2128, 80-2129, 80-2123, 80-2133, 80-2134, 80-2137, 80-2138, 80-2140, 80-2142, 80-2143, 80-2144, 80-2145, 80-2148, 80-2151, 80-2177, 80-2187, 80-2188, 80-2199, 80-2214, 80-2217, 80-2223, 80-2226, 80-2230, 80-2233 *and* 80-2236.

80-2367. Thielemann, H. (Lehrstuhl Allg. & Kommunale Hyg., Hyg. Inst., Martin-Luther Univ. Halle-Wittenberg, DDR-402 Halle, DDR) **Eine neue Moeglichkeit der Abtrennung und Identifizierung von Polyphenolen aus einem Poly-Monophenolgemisch mittels Duennschischtochromatographie. [New possibility to separate and identify polyphenols from a polyphenol-monophenol mixture by means of thin-layer chromatography.]** *Acta Hydrochim. Hydrobiol.* 7(2): 267-268; 1979 (German).

A method designed to separate mono- and polyphenol compounds [1,2,-, 1,3-, 1,4-dihydroxybenzene (catechol), 1,2,3-, 1,3,5- and 1,2,4-trihydroxybenzene] from a complex mixture by means of commercial foils impregnated with ammonium molybdate is described as suitable for application in the testing of water contaminants. The foils are made in the Czechoslovakia by Kavalier. The solvent used is a toluene: acetone: chloroform mixture (40:35:25). Presence of the above phenols is characterized by spots of varying colors. Monophenols and salicylic acid yield no spots.

80-2368. Koch, R. (Bezirkshygieneinspektion, DDR-65 Gera, DDR) **Circulare Duennschichtchromatographie als schnelle Methode zum qualitativen Nachweis Chlororganischer verbindungen. [Circular thin layer chromatography as a rapid method for the qualitative detection of organochlorine compounds.]** *Acta Hydrochim. Hydrobiol.* 7(3): 355-357; 1979 (3 references) (German).

Circular TLC is described as a method suitable for qualitative detection of organochlorine compounds. The mobile phase is supplied in the middle of a disc and chromatographic separation follows a circular centrifugal direction. The separated compounds form circular lines whose sequence from the inside out is HCB (hexachlorobenzene); *p,p'*-DDE; *p,p'*-DDT; *p,p'*-DDD (*p,p'*-TDE); γ-HCH (γ-BHC, lindane); heptachlorobiphenyl, pentachlorobiphenyl; and trichlorobiphenyl. The method yields best results when instrumentally applied in the form of capillary flow in the exact center (± 0.1 mm tolerance) of the disc. The advantages over linear TLC technique are the faster procedure and the minimum sample requirement (0.5 to 1.0 mm size spot made with 1 to 10 μl samples).

80-2369. Kuwahara, R.; Suzuki, T.; Meguro, H. (Lab. Anal. Chem., Fac. Agric., Tohoku Univ., Sendai, Japan) **Determination of a fungicide, triphenyltin chloride, in soil by the direct-insertion selected ion monitoring method.** *Agric. Biol. Chem.* 44(3): 669-670; 1980 (3 references).

A direct-insertion selected ion monitoring method is presented for use in determining triphenyltin chloride (fentinchloride) resides in soil. Dichloromethane was the best extraction solvent. Mass spectrometry at 30 eV ionizing voltage with a 300 μA ionizing current and 1.60 kV accelerating electron multiplier potential was used. Soil samples need not be reduced to ash using this method. Triphenyltin chloride was either absorbed or degraded within 1 day in both volcanic and alluvial soils. Soils kept in light or darkness exhibited no differences. The detection limit under the most appropriate conditions was 0.01 ppm. The method cannot be used for tomato, strawberry, flour or hog liver analysis since protein renders this extraction procedure ineffective.

80-2370. Krasnykh, A. A. (All-Russian Res. Inst. Plant Prot., Leningrad, USSR) **Khromatograficheskoe opredelenie eradikana v vode, pochve i rasteniyakh. [Chromatographic determination of Eradicane in water, soil, and plants.]** *Agrokhimiya* (3): 131-132; 1980 (Russian).

A method of simultaneous determination of 2 active ingredients of the herbicidal mixture Eradicane [eptam: (EPTC), S-ethyl-*N,N*-dipropylthiocarbamate; and Antidot (R 25788), *N,N*-diallyl-2,2-dichloroacetamide] in the soil, waterand plants was developed. The assay consists of extraction of toxicants with hexane, purification of extracts from coextractive substances, and thin layer silica gel chromatography. Sensitivity of the method is 3-5 μg/sample. Detectability is 82-91%.

80-2371. Goretti, G.; Lagana, A.; Petronio, B. M.; Russo, M. V. (Ist. Chim. Anal., Univ. Roma, I-00185 Rome, Italy) **Extraction and recovery of organophosphorus pesticides from water.** *Ann. Chim. (Rome)* 69(7-8): 457-461; 1979 (11 references).

The utilization of silicone-coated Perlite for the extraction of organophosphorus pesticides from water for analytical determinations was investigated. Isotherms were calculated of the distribution of various pesticides between water and Cleansol. Results indicated that pentane is a suitable solvent for these extractions. Yields were about 95%. It is noted from the isotherms that the behavior of these pesticides varied noticeably with their hydrophobic character. The addition of sodium chloride exerted a positive effect on recovery of organophosphorus pesticides from water. Cleansol has the advantage over Tenax of having a higher loading capacity and moreover it does not catalyze chemical reactions as does carbon.

80-2372. Lhuguenot, J. C.; Pochat-Pochatoux, N.; Witkowski, M.; Baron, C. (Lab. Biochim. Appliq., Ec. Natl. Super. Biol. Appliq. Nutr. Aliment., Campus Univ., F-21100 Dijon, France) **La detection des pesticides organophosphores a l'etat de traces par chromatographie gas liquide comparaison entre la capture d'electrons et la photometrie de flamme. [Detection of trace quantities of**

organophosphorus pesticides by comparison of electron capture detection and flame photometric gas liquid chromatography.] *Ann. Falsif. Expert. Chim.* 73(784): 139-152; 1980 (16 references) (French).

Results obtained by 2 gas liquid chromatographic detectors (flame photometry and electron capture detection) used in analyzing foods for organophosphorus pesticide residues were compared, and the behavior of these detectors towards organophosphorus and organochlorine pesticides were described. Flame photometry was found to be susceptible to background noise interference with trace analysis, specificity was excellent, detection threshold was 500 pg, simultaneous detection of organochlorine compounds was not possible, and the cleanup procedure was difficult. Variable frequency electron capture detection showed no background noise interference, no specificity and a detection threshold of 50 pg. Simultaneous detection of organochlorine compounds was possible up to 5 pg and cleanup was easy. The latter method is recommended.

80-2373. Shiaris, M. P.; Sherrill, T. W.; Sayler, G. S.* (Dep. Microbiol., Univ. Tennessee, Knoxville, TN 37916) **Tenax-GC extraction technique for residual polychlorinated biphenyl and polyaromatic hydrocarbon analysis in biodegradation assays.** *Appl. Environ. Microbiol.* 39(1): 165-171; 1980 (16 references).

A rapid Tenax-GC extraction technique has been evaluated for use in conjunction with aqueous biodegradation assays for polyaromatic hydrocarbons and polychlorinated biphenyls. The method was quantitatively efficient and reproducible for phenanthrene, but variable and not quantitative for Aroclor 1254 (PCB). Aqueous sample volumes and varying concentrations of organic matter influenced PCB and polyaromatic hydrocarbon extraction efficiency. Phenanthrene recovery was decreased by soil extract but unaffected by spent bacteriological culture medium. Both types of organic matter caused significant reduction of Aroclor 1254 recovery. Polyaromatic hydrocarbon and PCB biodegradation assays, performed with reservoir samples, supported the laboratory evaluation. The study demonstrated the utility of the Tenax-GC extraction technique for phenanthrene analysis in biodegradation assessment; however, Tenax-GC extraction was not appropriate for Aroclor 1254 biodegradation studies. (Author abstract by permission)

80-2374. Muth, G. L.; Erro, F. (Dep. Food & Agric., Berkeley, CA 94710) **A rapid carbamate multiresidue procedure for vegetable crops.** *Bull. Environ. Contam. Toxicol.* 24(5): 759-765; 1980 (4 references).

Sample preparation, cleanup, and concentration steps used for rapidly determining carbamate residues in vegetables are discussed. Water is used as the extracting solvent. The filter cell, a fine grade of diatomaceous earth, effectively trapped particular matter and adsorbed proteinaceous material when mixed at 2 parts sample to 1 part filter cell. The slurry produced on blending was then filtered through Celite in a Buchner funnel. The clarified aqueous extract was next passed through a reverse phase C18 Sep-pack. The carbamates were adsorbed on the Sep-pack while water, salts, pigments, carbohydrates and other materials passed through. The Sep-pack absorbant was an approximate 40 micron LC preparation stationary phase contained in a polypropylene capsule. Carbamates may be eluted off the Sep-pack with as little as 2 ml absolute methanol. The sample is then ready for the determinative step. The method was evaluated by determining recovery of the carbamates carbofuran (93%), carbaryl (90%), and methiocarb (85%) at the 5.0 ppm level.

80-2375. Brady, S. S.; Enos, H. F.; Levy, K. A. (Sch. Med., Univ. Miami, Miami, FL) **Chlorobenzilate residues in urine.** *Bull. Environ. Contam. Toxicol.* 24(5): 813-815; 1980 (5 references).

A method for determining 4,4′-dichlorobenzophenone (DBP) as an indicator of chlorobenzilate residues in urine of warm blooded animals and humans is described. To 5 ml samples of urine, 5 ml of an oxidizing reagent are added in a 60 ml separatory funnel. The funnel is covered and placed on an oven at 90°C for 1 hr. After cooling the oxidized sample is diluted with water and partitioned by shaking with hexane. The aqueous layer is drained, the sample is repartitioned and the second aqueous layer is added to the first. This layer is then partitioned with hexane and the hexane phase is collected and washed with water. The hexane layer from this washing is passed through a sodium sulfate filter, and concentrated under nitrogen in a 40°C water bath until a 5.0 ml volume is reached. The sample is then injected into a Gas Chrom Q gas chromatograph equipped with an ^{63}Ni detector. Average recoveries from fortified urine were 97% with standard deviations of 9%. The method is currently being used in a chlorobenzilate monitoring study.

80-2376. Billings, W. N.; Bidleman, T. F.* (Dep. Chem., Univ. South Carolina, Columbia, SC 29208) **Field comparison of polyurethane foam and Tenax-GC resin for high-volume sampling of chlorinated hydrocarbons.** *Environ. Sci. Technol.* 14(6): 679-683; 1980 (21 references).

The comparative efficiency of porous polyurethane foam (PPF) and Tenax-GC resin for collecting polychlorinated biphenyls (PCB) and chlorinated pesticides from 300-1600 m^3 of air was determined by side-by-side sampling with each adsorbent in the city of Columbia, S.C. Front and backup adsorbent traps were analyzed separately to determine the penetration of chlorinated hydrocarbon vapors. Low molecular weight PCB (Aroclor 1016) was effectively retained by both adsorbent systems at air volumes of 300-700 m^3. Hexachlorobenzene (HCB) was

very poorly retained by PPF, but efficiently collected by Tenax. Throughout the air volume range both solid adsorbents had very good collection efficiency (> 95% of the material found on the front adsorbent trap) for higher molecular weight PCB (Aroclor 1254), chlordane, DDT, and toxaphene. Average relative standard deviations for replicate collections with a given adsorbent ranged from 8 to 22%. Side-by-side measurements of CHC in Columbia air using PPF and Tenax agreed within 5-15% except for HCB, for which higher values were determined by Tenax sampling. (Author abstract reprinted by permission of the American Chemical Society)

80-2377. Specht, W.; Tillkes, M. (Lab. Rueckstandsanal., D-2000 Hamburg, BRD) **Gas-chromatographische Bestimmung von Ruekstanden an Pflanzenbehandlungsmitteln nach Clean-up ueber Gel-Chromatographie und Mini-Kieselgel-Saulen-Chromatographie. 3. Mitteilung. Methode zur Aufarbeitung von Lebensmitteln und Futtermitteln pflanzlicher un tierischer Herunfit fuer die Multrueckstandsbestimmung lipoid-und wasserloeslicher Pflanzenbehandlungsmittel. [Gas-chromatographic determination of pesticide residues after clean-up by gel-permeation chromatography and mini-silica gel-column chromatography. 3. Communication. Clean-up of foods and feeds of vegetable and animal origin for multiresidue analysis of fat-soluble and water-soluble pesticides.]** *Fresenius Z. Anal. Chem.* 301(4): 300-307; 1980 (13 references) (German).

A method is described for the clean-up of foods and feeds in the multiresidue analysis of lipoid- and water-soluble pesticides and their metabolites by gel-permeation chromatography (GPC). Pesticides of different polarity are extracted with acetone from samples of different water content using a constant acetone/water ratio of 2:1. Fats are dissolved in ethyl acetate:cyclohexane (1:1). Co-extracted sample constitutents of higher molecular weight are removed by gel-permeation chromatography on a polystyrene gel (Bio Beads S-X3) with ethyl acetate/cyclohexane (1:1) as eluting solvent. All of the 90 pesticides, tested up to now, are recovered in 65 ml of the subsequent eluate. The concentrated eluate can generally be used for GC-determination by element-specific detectors. For the elimination of interfering substances a simple column chromatography on deactivated silica gel is described, especially for the determination of organohalogen, pesticides in the ppb range. Using element-specific detectors for GC-determination, the mini-column chromatography is also suitable for identification or additional clean-up. (Author abstract by permission)

80-2378. Gallagher, R. T.; Stahr, H. M.* (Vet. Diagn. Lab., Coll. Vet. Med., Iowa State Univ., Ames, IA 50011) **Identification of a potential interference in analysis of aflatoxin 2,4-dimethyl-6-ethoxyquinoline, a reaction product of ethyoxyquin.** *J. Agric. Food Chem.* 28(1): 133-135; 1980 (20 references).

Investigation of the chromatography and chemical reactions of ethoxyquin has provided the chemical identity of a reaction product of ethoxyquin which could interfere in the analysis of mixed commercial feeds for aflatoxin. This product occurs in commercial feeds. Chemically it is 2,4-dimethyl-6- ethoxyquinoline. Spectrometric data have been used to confirm its identity. (Author abstract reprinted by permission of the American Chemical Society)

80-2379. Gardner, R. C.; McKellar, R. L. (Residue Environ. Metab. Res., Agric. Prod. Dep., Dow Chem. Co., Midland, MI 48640) **A method to determine dinoseb residues in crops and soil by gas chromatography.** *J. Agric. Food Chem.* 28(2): 258-261; 1980 (7 references).

A method is described for the determination of residues of dinoseb (2-*sec*-butyl-4, 6-dinitrophenol) in alfalfa, corn, cottonseed, field beans, almonds, peanuts, peas, potatoes, soybeans, grapes, oranges, peaches, pears, barley, wheat, and soil at levels ranging from 0.05 to 100 ppm. Dinoseb is first extracted by hot hydrolysis in methanol-sulfuric acid and subsequently partitioned into diethyl ether and adsorbed onto basic alumina. After elution with sodium bicarbonate, ether partition, and diazomethane methylation, the dinoseb methyl ether is adsorbed onto acidic alumina and eluted with ether. Electron-capture gas chromatography provides a sensitive means of quantifying residues of dinoseb down to 20 pg. Average recoveries ranged from 77 to 99%. (Author abstract reprinted by permission of the American Chemical Society)

80-2380. Insalaco, S. E.; Makarewicz, J. C.*; Vestling, M. M. (Dep. Biol. Sci., State Univ. New York, Brockport, NY 14420) **Routine determination of mirex and photomirex in fish tissue in the presence of polychlorinated biphenyls.** *J. Agric. Food Chem.* 28(2): 261-265; 1980 (21 references).

A procedure for the routine determination of mirex and photomirex in fish tissue is described which provides rapid analysis and confirmation using conventional gas chromatographic electron capture detection (GC/ECD) methods. Coeluting interferences (polychlorobiphenyls, PCB's) are nitrated allowing for simple separation from mirex analog by column chromatography. In chinook salmon tissue (*Oncorhynchus tshawytscha*), PCB removal averaged 78% and mirex and photomirex recoveries were 91 and 86%, respectively. The method has been used successfully for trace analysis of mirex levels as low as 100 pg. (Author abstract reprinted by permission of the American Chemical Society)

80-2381. Sonobe, H.; Carver, R. A.*; Kamps, L. R. (Div. Chem. & Phys., US FDA, Washington, DC 20204)

Potential interference by free fatty acids in the gas-liquid chromatographic analysis of rice bran for pesticide residues using electron capture, potassium chloride thermionic, and Hall electrolytic conductivity detectors. *J. Agric. Food Chem.* 28(2): 265-269; 1980 (16 references).

Free fatty acids were found to be potential interferences in the gas-liquid chromatographic (GLC) determinative step when rice bran was analyzed for pesticide residues using the multiresidue analytical procedure for fatty food in the Food and Drug Administration Pesticide Analytical Manual. Oil was extracted from the rice bran and cleaned up by petroleum ether- acetonitrile partitioning and Florisil column chromatography. The residues were determined by GLC. Chromatographic peaks encountered with electron capture, potassium chloride thermionic, and Hall electrolytic conductivity detectors were identified as palmitic acid, oleic acid, and linoleic acid. The oil extracted from the rice bran contained an unusually high quantity of free fatty acids, 54.4% as oleic acid. Cleanup of rice bran oil using petroleum ether- acetonitrile partitioning and Florisil column chromatography failed to separate the fatty acids from possible pesticide residues. The GLC response factor for several free fatty acids and their methyl esters was determined using electron capture, potassium chloride thermionic, and Hall electrolytic conductivity detectors. (Author abstract reprinted by permission of the American Chemical Society)

80-2382. Newsome, W. H. (Food Res. Div., Bureau Chem. Saf., Food Dir., Natl. Health & Welfare, Tunney's Pasture, Ottawa, Ontario K1A OL2, Canada) **A method for the determination of maleic hydrazide and its β-D-glucoside in foods by high pressure anion exchange liquid chromatography.** *J. Agric. Food Chem.* 28(2): 270-272; 1980 (9 references).

A method was developed for the determination of maleic hydrazide and its β-D-glucoside in foods by high pressure liquid chromatography with detection by light absorption at 313 nm. Both maleic hydrazide and the glucoside were extracted from plant tissue with methanol, and the extract was concentrated. Maleic hydrazide was cleaned up by passage through Amberlite XAD-2 and Dowex 50 resins, while cleanup of the glucoside was effected with a column consisting of Amberlite XAD-2, Dowex 1, and Dowex 50 resins. Maleic hydrazide glucoside was then hydrolyzed with β-glucosidase and the maleic hydrazide was determined by liquid chromatography. Recoveries of free maleic hydrazide added to four commodities from 1 to 50 ppm averaged 87%. The same average recovery was obtained with the glucoside fortified at levels from 2 to 50 ppm. (Author abstract reprinted by permission of the American Chemical Society)

80-2383. Newsome, W. H. (Food Res. Div., Bur. Chem. Saf., Food Dir., Dep. Natl. Health & Welfare, Tunney's Pasture, Ottawa, Ontario K1A OL2, Canada) **Determination of daminozide residues on foods and its degradation to 1,1-dimethylhydrazine by cooking.** *J. Agric. Food Chem.* 28(2): 319-322; 1980 (9 references).

Daminozide was determined by alkaline hydrolysis to dimethylhydrazine. The dimethylhydrazine was recovered by distillation, derivatized with pentafluorobenzoyl chloride, and determined by GLC. Recoveries from several commodities fortified from 0.10 to 40 ppm were generally greater than 80%. 1,1-Dimethylhydrazine was determined in apples by extraction with 0.01 N HCl, chromatography on a cation-exchange resin, and derivatization with pentafluorobenzoyl chloride. The resulting 1,1-dimethyl-2,2- *bis*(pentafluorobenzoyl) hydrazine was cleaned up on a silicic acid and quantitated by GLC. Recoveries averaged 88% from 0.10 to 12 ppm. Daminozide was found to decompose to dimethylhydrazine when boiled in apple homogenate. The amount of decomposition increased with the duration of boiling from 10 to 60 min and with the amount of daminozide from 5 to 30 ppm. (Author abstract reprinted by permission of the American Chemical Society)

80-2384. Lawrence, J. F.; van Buuren, C.; Brinkman, U. A. T.; Frei, R. W. (Food Res. Div., Food Dir., Health & Prot. Branch, Ottawa, Ontario K1A OL2, Canada) **Use of ethylation for the gas and liquid chromatographic determination of linuron, diuron, and metoxuron and two of its degradation products: application to soil analysis.** *J. Agric. Food Chem.* 28(3): 630-632; 1980 (14 references).

The urea herbicides linuron, diuron, and metoxuron and its metabolites, monomethylmetoxuron and desmethylmetoxuron, were ethylated using ethyl iodide and sodium hydride in dimethyl sulfoxide, with a reaction time of 30 min at room temperature. The products proved to be exceptionally stable and well suited to gas chromatography. The structures were confirmed by gas chromatography-mass spectrometry. Separation of all the test compounds as their ethyl derivatives was achieved by both gas and liquid chromatography. Successful determination of metoxuron and diuron in soil at 1.0 ppm was accomplished by both gas and liquid chromatography. Selective nitrogen-phosphorus detection proved to be superior to electron-capture determination of the two herbicides in soil. Direct liquid chromatographic determination of the two ureas in soil was also possible. The minimum detectable concentrations of metoxuron in the samples was estimated to be less than 50 ppb by gas chromatography with nitrogen-phosphorus detection. The reproducibility of replicate standards carried through the ethylation procedure and analyzed by gas chromatography was 6% relative standard deviation. (Author abstract reprinted by permission of the American Chemical Society)

80-2385. Lamparski, L. L.; Langhorst, M. L.; Nestrick, T. J.; Cutie, S. (Anal. Lab., Environ. Anal., Dow Chem.

Co., Midland, MI 48640) **Gas-liquid chromatographic determination of chlorinated benzenes and phenols in selected biological matrices.** *J. Assoc. Off. Anal. Chem.* 63(1): 27-32; 1980 (23 references).

The determination of higher chlorinated benzenes and chlorinated phenols at ppb or ppm levels in biological samples is described. The method includes sulfuric acid digestion, silica gel column chromatography, methylation, alumina column chromatography, and detection by electron capture gas chromatography. Recoveries are reported for fish flesh, rabbit tissues, and duck tissues with detection limits of 10-15 ppb (ng/g tissue). (Author abstract by permission)

80-2386. Vickrey, T. M.; Karlesky, D. I.; Blackmer, G. L. (Dep. Chem., Texas A&M Univ., College Station, TX 77843) **Colorimetry and high performance liquid chromatography of atrazine residues in soil: comparison of methods.** *J. Assoc. Off. Anal. Chem.* 63(3): 506-510; 1980 (8 references).

The colorimetric method for determining residual atrazine levels in soil is compared with reverse phase high performance liquid chromatography (HPLC). The soil samples are extracted with water + acetonitrile (10 + 90) and the filtrate is partitioned with methylene chloride. For the colorimetric analysis the organic phase is filtered through activity V alumina, collected, and evaporated to dryness. The residue is dissolved first in ethyl ether, and then in water as the ether is removed. The atrazine solution is buffered (citric acid, pH 7.0) and heated with added pyridine. When the reaction is complete, the product is complexed with ethyl cyanoacetate, and the solution absorbance is measured at 550 nm. The complex obeys Beer's law and has a sensitivity of 230 ng for a 1% full scale deflection at 1 AUFS. For the HPLC method, the methylene chloride extract is dried, the chromatographic solvent is quantitatively added (either chloroform or methanol), and the solution is analyzed with a UV detector at 254 nm. Minimum amount detectable for a 1% full scale deflection is 5 ng at 0.01 AUFS. Soil background interferences were investigated for both methods, and buffering the pyridine-triazine reaction solution was the most efficient method for removing the background for colorimetry. The recovery efficiencies for the colorimetric and HPLC methods were 45.5 ± 3.8% and 94.4 ± 3.4%, respectively. (Author abstract by permission)

80-2387. Bardalaye, P. C.; Thompson, N. P.; Carlson, D. A. (Pestic. Res. Lab., Univ. Florida, Gainesville, FL 32611) **Sensitive gas-liquid chromatographic method for asulam residues in peaches.** *J. Assoc. Off. Anal. Chem.* 63(3): 511-516; 1980 (5 references).

The current analytical method for determining residues of the herbicide asulam[methyl-(4-aminobenzenesulfonyl)carbamate] is the nonspecific colorimetric procedure based on the coupling reaction of *N*-1-naphthylethylenediamine with the diazotized amine. A new analytical method for determining the residues of this herbicide and its 2 known major metabolites, acetylasulam and sulfanilamide, in peaches has been developed and evaluated using gas chromatography with an N-P detector. The method is based on the hydrolytic conversion of the parent compound and the known metabolites to the common product sulfanilamide, which is then analyzed by gas liquid chromatography as its per *N*-methylated derivative. The identity of the derivative has been confirmed by chemical ionization mass spectrometry. The method was tested by using fortified crop extracts and also by analyzing crop treated by postemergent application of the herbicide for weed control. Sensitivity of the method is 5 ng and the detection limit in the crop is 0.1 ppm. Recoveries ranged from 70 to 89% from peaches at fortification levels of 1, 5, and 10 ppm. At a fortification level of 0.1 ppm the recovery is 50-60%. (Author abstract by permission)

80-2388. Ferreira, J. R.; Silva Fernandes, A. M. (Prot. Prod. Agric., Quinta do Marques,Oeiras, Portugal) **Gas-liquid chromatographic determination of organophosphorus insecticide residues in fruits and vegetables.** *J. Assoc. Off. Anal. Chem.* 63(3): 517-522; 1980 (16 references).

A method intended for regulatory purposes is described for the determination of organophosphorus insecticide residues in fruits and vegetables. Eighteen organophosphorus insecticides, azinphos-ethyl, chlorpyrifos, diazinon, dichlorvos, dimethoate, ethion, ethoate-methyl, fenitrothion, fenthion, formothion, malathion, methidathion, mevinphos, parathion, phosalone, phosphamidon, thiometon, and trichlorfon, and 7 metabolites, fenitrooxon, fenthion sulfoxide, fenthion sulfone, malaoxon, desethylphosphamidon, thiometon sulfoxide, and thiometon sulfone, were extracted from different crops with acetone and partitioned into hexane or ethyl acetate, according to their polarities. The hexane extract was cleaned up by eluting from a Florisil column with acetone-hexane (4 + 96). The ethyl acetate extract needs no cleanup. The concentrated extracts were analyzed by gas-liquid chromatography using thermionic detectors. Recoveries conducted at fortification levels ranging from 0.1 to 2 mg/kg were in most cases above 80%. The limit of sensitivity is less than 0.1 mg/kg. (Author abstract by permission)

80-2389. Woolson, E. A.; Aharonson, N. (Pestic. Degradation Lab., USDA, Beltsville, MD 20705) **Separation and detection of arsenical pesticide residues and some of their metabolites by high pressure liquid chromatography – graphite furnace atomic absorption**

spectrometry. *J. Assoc. Off. Anal. Chem.* 63(3): 523-528; 1980 (17 references).

A method was developed for the separation and quantitative determination of arsenite (arsenic trioxide), methane arsonic acid (MAA), dimethyl arsinic acid (cacodylic acid or CA), and arsenate by high pressure liquid chromatography coupled to a graphite furnace atomic absorption (GFAA) detector. The compounds are separated on a low capacity anion exchange column with gradient elution from 100% water + methanol (80 + 20, v/v) to 100% 0.02 *M* $(NH_4)_2CO_3$ + methanol (85 + 15, v/v) at 1.2 ml/min and a pressure of about 300 psi. The HPLC was coupled by an automatic sampling unit of the GFAA through an interface consisting of a Teflon flow-through sampling cup. Limit of detection for the arsenic compounds was about 5 ng As injected in aliquots of 20 μl (0.25 ppm As in solution). All 4 arsenical compounds gave similar calibration curves, which were linear from 0.1 to 2.0 ng for single atomizations in the GFAA and from 5 to 200 ng when multiple, sequential atomizations of HPLC eluant were used to quantitate HPLC peaks. Quenching by soil extracts as well as aqueous HPLC solvents was minimal. (Author abstract by permission)

80-2390. Heath, A. B.; Black, R. R. (Board Tick Control, Residue Lab., New South Wales Dep. Agric., Lismore, New South Wales, Australia) **Improvements to assisted distillation cleanup of pesticide residues in animal fats.** *J. Assoc. Off. Anal. Chem.* 63(3): 529-531; 1980 (2 references).

The assisted distillation technique, which was developed for the cleanup of pesticide residues from animal fats, has been improved. Nitric acid cleaning of distillation tubes resulted in a significant improvement in the recoveries of hexachlorobenzene (HCB) and lindane (from 76 to 92% and 84 to 89%, respectively). A larger U-tube condenser was developed that condensed 100% of all pesticides studied. With this new condenser, a study of distillation tube flow rates showed that pesticide recoveries at 600 ml nitrogen/min were generally better than those obtained at any other flow rate, although recoveries were satisfactory at 400 and 800 ml/min. Recoveries of pesticides at distillation temperatures of 210-240°C were obtained with tubes cleaned with nitric acid, and using the larger U-tube condenser. The distillation temperature of choice was again 230°C because there was little variation from 220 to 240°C. (Author abstract by permission)

80-2391. Veierov, D.; Aharonson, N. (Div. Pestic. Residues & Nat. Prod., Agric. Org. Chem., Agric. Res. Organ., Volcani Cent., Bet Dagan, Israel) **Economic method for analysis of fluid milk for organochlorine residues at the 10 ppb level.** *J. Assoc. Off. Anal. Chem.* 63(3): 532-535; 1980 (23 references).

A procedure is described to isolate and clean up organochlorines in fluid milk for gas chromatographic (GC-ECD) analysis. Extraction and cleanup are performed in the same glassware, an ordinary separatory funnel. The only chemicals needed are H_2SO_4 and petroleum ether. Size of milk samples is versatile, provided proportions of the chemicals are adjusted accordingly. Recoveries greater than 80% are obtained for 18 common organochlorines added to milk which correspond well with official methods for determining incurred residues. The proposed procedure shows a low lipid carry-over (about 1%), and extraneous interferences are minimal. Its inherent simplicity makes the method suitable for standardization, and the small number of operations permit semi or full automation. (Author abstract by permission)

80-2392. Nanda Kumar, N. V.; Ramasundari, M. (Dep. Zool., Sri Venkateswara Univ., Tirupati 517502, India) **Colorimetric determination of methyl parathion and oxygen analog.** *J. Assoc. Off. Anal. Chem.* 63(3): 536-538; 1980 (21 references).

A simple, sensitive, and rapid colorimetric method is described for determining methyl parathion (*O,O*-dimethyl- *O*-*p*-nitrophenyl phosphorothioate) and methyl paraoxon (*O,O*-dimethyl- *O*-*p*-nitrophenyl phosphate), using *p*-nitrobenzene diazonium fluoroborate as the chromogenic salt. This colorimetric method is more sensitive than are other colorimetric methods based on nonenzymatic reactions. Pig liver acetone powder cholinesterase was found to be sensitive to methyl parathion. Inhibition can be detected at picogram levels, and 50-80 ng methyl paraoxon and 1-9 μg methyl parathion can be estimated. (Author abstract by permission)

80-2393. Clower, M., Jr. (Div. Chem., & Phys., US FDA, Washington, DC 20204) **Modification of the AOAC method for determination of fumigants in wheat.** *J. Assoc. Off. Anal. Chem.* 63(3): 539-545; 1980 (10 references).

The official first action AOAC method for determination of residues of fumigants in grains has been modified for use by 6 laboratories in an FDA pesticide surveillance program. A 15% OV-17 gas-liquid chromatographic column, installed in a chromatograph equipped with a constant current ^{63}Ni electron capture detector, provides for improved resolution, multi-residue capability, and lower limits of detection. A study was made of the behavior of chloroform, carbon tetrachloride, ethylene dichloride, trichloroethylene, trichloroethylene, tetrachloroethylene, (perchloroethylene), and ethylene dibromide through the method. Recoveries from fortified wheat samples averaged 105-115%. Experimental evidence is presented which suggests that part of the consistent trend toward high recovery can be attributed to selective sorption of acetone by the $CaCl_2$ used in the final drying step. (Author abstract by permission)

80-2394. Barry, C.; Pike, R. K. (Lab. Serv. Div., Agric. Canada, Ottawa, Ontario K1A OC5, Canada) **High**

pressure liquid chromatographic determination of difenzoquat in formulations. *J. Assoc. Off. Anal. Chem.* 63(3): 647-649; 1980.

Difenzoquat (1,2-dimethyl-3, 5-diphenylpyrazolium ion) as its methyl sulfate is extracted from commercial pesticide formulations with acetonitrile + water (1 + 1), with acetophenone added as internal standard. The sample is chromatographed by reverse phase high pressure liquid chromatography with UV detection at 280 nm. Peak area ratios are used for quantitative measurement. The method is simple, rapid, and direct, and its applicability to other quaternary ammonium herbicides is discussed. (Author abstract by permission)

80-2395. McDermott, W. H. (Union Carbide Agric. Prod. Inc., Woodbine, GA 31569) **High performance liquid chromatographic determination of carbaryl insecticide in formulations.** *J. Assoc. Off. Anal. Chem.* 63(3): 650-652; 1980 (2 references).

A high performance liquid chromatographic method for carbaryl in formulations has been developed and used to assay 3 formulations in a 10-day repeatability study. The method uses a cyano modified silica gel column packing and a mobile phase of heptane + methylene chloride + isopropanol + methanol (60 + 35 + 4.8 + 0.2). The coefficients of variation for 2 wettable powders and one aqueous flowable formation were 0.61, 0.62, and 0.75%, respectively. It is recommended that a collaborative study be conducted on this method. (Author abstract by permission)

80-2396. Griest, W. H.; Martin, T. W.* (Dep. Chem., Vanderbilt Univ., Nashville, TN 37235) **Stimulated sequential dehydroxy-fluorination: a safe, convenient method for gas chromatographic analysis of phosphate diesters with possible application to hydrolysates of organophosphorus pesticides and nerve gases.** *J. Chromatogr.* 192(1): 173-184; 1980 (47 references).

Model studies with di-*n*-butylphosphate show that organic triester derivatives chosen to gain increased volatility by simply minimizing total molecular weight are relatively poorer in gas chromatographic properties than the diesterphosphorofluoridate analogue because both the molecular weight and the overall polarity of the derivative are critical factors. We find the substitution of the hydroxyl group by fluorine is the most successful way at present to derivatize phosphate diesters. Fluorine substitution is effective because it reduces the strong phosphoryl dipole, presumably by decreasing the electron density on the oxygen atom via $p\pi-d\pi$ backbonding to the phosphorus. Dehydroxy-fluorination is best carried-out by a sequential reagent process starting with dicyclohexylcarbodiimide to stimulate and direct the dehydroxy-step before adding hydrogen fluoride as the active fluorinating agent. This procedure is safe and convenient and is believed applicable to a wide range of hydroxyphosphates including the hydrolysates of many organophosphorus pesticides and nerve gases at minimal sample sizes. (Author abstract by permission)

80-2397. Furness, G. O.; Howard, R. T.; Smith, P. J. (Res. Cent., Dep. Agric. & Fish., Loxton, South Australia 5333, Australia) **Measurement of petroleum oil deposits on citrus leaves by gas liquid chromatography.** *Pestic. Sci.* 10(6): 478-484; 1979 (6 references).

The quantity of oil deposited on citrus leaves when sprayed with oil-in-water emulsions was determined by gas-liquid chromatography of a diethyl ether extract of the leaves. Recovery of oil diminished rapidly as the time interval between spraying and extraction increased; this effect must be recognized when the method is applied. (Author abstract by permission)

80-2398. Akabane, A.; Tanaka, S.; Tanaka, S.; Urashima, M.; Yukawa, M. (Author address not given) **[Studies on the analytical method for determining bromine in urine.]** *Proc. Annu. Meet. Jpn. Soc. Ind. Hyg.* 53: 313-314; 1980 (Japanese).

The absorbancy-analytical method for determination of bromine in urine as an index of exposure to methyl bromide was studied. A combustion temperature of 600°C, an oxidation time of 10 min and carbon tetrachloride as the extraction solvent were adopted. The coloration of an aqueous solution of mercuric thiocyanate was not affected until the chlorine concentration reached 6 g/l. The recovery rate of bromine was 92% with a fluctuation coefficient of 4.0%. The result of cross-check with the radio-activation analysis was favorable, with a correlation coefficient of 0.882. However, a slightly lower value was obtained by the absorbency-analytical method (mercuric thiocyanate method) than the activation-analysis method. The difference is suggested to be due to the loss when urine is combusted. The mean content of bromine in the urine of persons engaging in fumigation with methyl bromide was 8.8 ± 5.2 mg/l (77 persons). The urine of controls contained 6.5 ± 2.4 mg/l.

80-2399. Mestres, R.; Illes, S.; Campo, M.; Tourte, J. (Lab. Chim. Appl. Expert., Fac. Pharm. Montpellier, Montpellier, France) **Developpement de la methode polyvalente d'analyse des residus de pesticides dans les plantes et les matieres alimentaires d'origine vegetale. [Development of the multiple residue analysis of pesticides in plant materials and foods of plant origin.]** *Trav. Soc. Pharm. Montpellier* 39(4): 323-328; 1979 (3 references) (French).

A procedure for multiple pesticide residue analysis of plant material is presented. The method involves extraction with ethyl acetate: dichloromethane, subsequent

preparation of 2 secondary extracts A and B with acetonitrile: petroleum ether and adsorption chromatography on florisil. The purified extracts are then analyzed by gas chromatography using an electron capture detector, flame photometry or alkaline flame ionization. Recovery data from various crops for 42 pesticides are presented in tabular form.

80-2400. Mestres, R.; Espinoza, Cl.; Chevallier, Ch.; Marti, G. (Lab. Chim. Appl. Expert., Fac. Pharm. Montpellier, Montpelier, France) **Note sur l'analyse des residus de decamethrine. [On the analysis of decamethrin residues.]** *Trav. Soc. Pharm. Montpellier* 39(4): 329-336; 1979 (3 references) (French).

Analytical steps which meet the requirements for trace analysis of decamethrin residues in all types of crops and animal products are identified. Depending on the crop or product acetonitrile or petroleum ether: ethyl alcohol is used for extraction, acetonitrile: petroleum ether or DMSO: petroleum ether for purification, and chromatography on florisil or gas chromatography with an electron capture detector for analysis. The methods are applicable to determining trace amounts routinely encountered. In cases of greater residues the extracts must be appropriately diluted. Several possible alternative procedures suitable for different types of samples to be analyzed are described. Recoveries obtained from various crops and products are presented in tabular form, and range from 67-100%.

See also 80-2143, 80-2189 *and* 80-2313.

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